Vision for Competitiveness: Mid-Decade Opportunities for Strategic Victory

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The Special Competitive Studies Project is a bipartisan, non-profit project with a clear mission: to make recommendations to strengthen America's long-term competitiveness as artificial intelligence (AI) and other emerging technologies are reshaping our national security, economy, and society.

Vision for Competitiveness: Mid-Decade Opportunities for Strategic Victory reflects the work that SCSP has conducted since its outset. It builds off of the first Mid-Decade Challenges to National Competitiveness report and is the culmination of research, analysis, and collaboration by the dedicated SCSP team.

REMEMBERING

Dr. Henry A. Kissinger

The Special Competitive Studies Project remembers with respect and gratitude Dr. Henry Kissinger, whose intellectual legacy continues to inspire our work. SCSP draws its inspiration in part from the Special Studies Project, a bipartisan endeavor led by Dr. Kissinger in the 1950s that was aimed at defining the major problems and opportunities that the United States confronted as it shifted from the aftermath of World War II and faced an ideological adversary striving for nuclear parity.

Yet despite his work on the geopolitical and diplomatic challenges of the 20th century, Dr. Kissinger's later years were marked by a keen interest in the implications of technological advancements, notably artificial intelligence (AI), on human reasoning, international relations, and national security. Often, Dr. Kissinger advocated for the thoughtful integration of AI into strategic considerations. He warned of its potential consequences while also highlighting the unprecedented opportunities it presents for diplomacy, intelligence, and warfare.

Inspired by Dr. Kissinger's foresight into the transformative potential of AI and its ability to reshape the strategic landscape, SCSP is focused on the imperative of integrating emerging technologies within the broader strategic context. Our work on adapting to and leveraging new technologies for national competitiveness purposes is informed by Dr. Kissinger's involvement in discussions on AI governance and the potential for AI to alter the balance of power. Today, it continues to align with the project's objective of harnessing technological progress for strategic advantage while mitigating risks.

It is our hope that this paper, written in the style of a document that, 25 years after its drafting, was declassified by Dr. Kissinger himself, will serve as a beacon for navigating the complexities of the 21st-century strategic environment.

Dr. Eric Schmidt Chair, SCSP

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Ylli Bajraktari President, SCSP

PREFACE

National Security Council Paper NSC-68

NSC-68 — officially A Report to the National Security Council by the Executive Secretary on United States Objectives and Programs for National Security — is one of the defining documents of the Cold War.¹ It assessed, in 1950, the United States and Soviet Union's ambitions and capabilities, and laid out the logic of what would become Washington's strategic posture toward Moscow for the next four decades.

The paper had its origins in the perceived failure of the United States to effectively counter Soviet aggression in the immediate aftermath of the Second World War. On August 29, 1949, the Soviet Union successfully detonated its first atomic bomb, ending the American monopoly on nuclear weapons. Two months later, the establishment of the People's Republic of China confirmed that communism had metastasized to the most populous country in the world. As communist expansionism threatened Europe and Asia, U.S. policymakers lacked a coherent strategic vision: some believed in pursuing detente, others in containment or more confrontational strategies.

In response to these crises, President Harry Truman tasked a special committee to provide him with the way forward. It was this re-examination, led by Director of Policy Planning Staff Paul Nitze, that would become the top secret document NSC-68. Circulated on April 14, 1950, the document provided a strategic vision for addressing the Soviet threat. In the words of Secretary of State Dean Acheson, NSC-68 was meant "to so bludgeon the mass mind of 'top government' that not only could the president make a decision but that the decision could be carried out."²

To do so, NSC-68 depicted a world split between two irreconcilable ideologies. It argued that the Soviets, driven by a creed antithetical to that of the free world, were determined to achieve world domination. In

¹<u>A Report to the National Security Council by the Executive Secretary on United States Objectives and Programs for National Security</u>, U.S. Department of State (1950).

² James M. Lindsay, <u>TWE Remembers: NSC-68</u>, Council on Foreign Relations (2012) (quoting Dean Acheson, <u>Present at the Creation:</u> <u>My Years in the State Department</u>, W. W. Norton & Company at 374 (1969)).

response, NSC-68 called for a buildup of the U.S. military and a global strategy of containment. It crystallized the worldview and strategy that would guide U.S. policy for the duration of the Cold War.

This Vision for Competitiveness is inspired by the purpose, clarity, and structure of NSC-68. The Special Competitive Studies Project shares a similar objective: to put forward a strategy for the United States and the free world in an era of rapid technological advances and existential geopolitical competition.

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Introduction

When we first started our work, originally at the National Security Commission on Artificial Intelligence from 2018 to 2021, and then as the Special Competitive Studies Project since October 2021, we were convinced that two complex sets of factors were altering the distribution of power for this decade, and for three futures beyond — the futures of geopolitics, technology, and democracy. The first set of factors we foresaw was the arrival of AI. The second set was the emergence of technology as the key battleground in the intensifying geostrategic competition between the United States and the People's Republic of China (PRC). The events that have transpired since have only solidified our conviction. The introduction of ChatGPT in November 2022 visibly ushered in the age of AI — initially in the form of generative AI, but undoubtedly as a prelude to even more powerful forms of artificial intelligence, including artificial general intelligence (AGI). Since then, the downstream opportunities that have emerged from generative AI, the influx of capital to AI-related endeavors, and the demand for AIpowering chips have all been further evidence of this new age.

As Al continues to proliferate and advance, it and other emerging technologies have continued to gain prominence in the U.S.-China competition. Microelectronics, advanced networks, biotechnology, energy, and advanced manufacturing are all key technological battlegrounds on which America's and China's relative positional advantages are being decided, and with them, the destiny of the world order.³ And Beijing appears determined to dominate in all. Part of this determination is fueled by a desire to reduce dependencies on foreign technologies and preserve its leeway to make foreign policy decisions, including for potential action against Taiwan. Another part is fueled by the Chinese Communist Party's (CCP) desire to control its large population: what it reads, writes, buys, listens to, and thinks. Yet another part is fueled by the view that the only way out of China's current economic and demographic conundrum, and the most assured path toward global influence, is to command the next technological frontier — or what the Chinese leader, Xi Jinping, has called the "new productive forces."⁴ As China pursues these emerging technologies, it is also focusing on a next wave of technologies — what it terms "future industries," including photonic computing, brain-computer interfaces, nuclear fusion, and digital twins.⁵

³ <u>Mid-Decade Challenges to National Competitiveness</u>, Special Competitive Studies Project (2022).

⁴ James Pomfret, et al., <u>China's Xi Jinping Summons 'New Productive Forces'</u>, <u>But Old Questions Linger</u>, Reuters (2024).

⁵ <u>How Xi Jinping Plans to Overtake America</u>, The Economist (2024).

China continues to be the most formidable competitor the United States has ever faced. It is also in many ways a deeply flawed one. China had a troubled exit from the COVID-19 pandemic that hobbled its postlockdown economic recovery.⁶ Coupled with deeper and more structural economic challenges that Beijing faces, the current slowdown has delayed — possibly in perpetuity — its aspiration of becoming the largest economy in the world. China's real estate sector, previously a major component of its infrastructure investments and a driver of its economic growth, is engulfed in a crisis that has alarmed domestic consumers and foreign investors alike.⁷ Its population has peaked and is now on a downward trajectory,⁸ while youth unemployment remains high.⁹ What is more, its leader Xi Jinping, now in an unprecedented third term in office, appears intent on prioritizing security above all else. Whether it be saber rattling over Taiwan¹⁰ or gunboat diplomacy with the Philippines,¹¹ China's security-first approach is turning the Chinese market radioactive for foreign investors.¹² Yet these systemic flaws do not make the PRC's plans and intentions for technological dominance less concerning, and they are unlikely to bring about the downfall of the Chinese Communist Party. However, they should be recognized and factored into any strategy designed to counter China, not least because its current economic and demographic squeeze could make the PRC even more aggressive abroad.

In addition to the persistent threat posed by China, perhaps the most concerning geopolitical development of the past two years has been the emergence of an "Axis of Disruptors": a tacit coalition of like-minded and similarly governed nations — China, Russia, Iran, and North Korea — united in their desire to upend the current world order.¹³ Having sensed a hollowing out of allied defense capabilities, a fractured political will, fragile unity of purpose, natural resource and manufacturing dependencies, and social fault lines vulnerable to disinformation, these countries appear intent on pushing the current world order to a breaking point. Their actions may not yet be synchronized in time and space, but they appear united on intent and are similar in tactics. This is most obvious in Ukraine, where the Russian war of aggression is being sustained in significant ways with material support from China, Iran, and North Korea.¹⁴ There is also considerable alignment of public messaging, including disinformation.¹⁵ Likewise,

⁶ Emily Feng, <u>Concerns Grow as Post-COVID Economic Recovery in China Flounders</u>, NPR (2023).

⁷ Cao Li, <u>China's Real-Estate Market Just Set a Record—but Not a Good One</u>, Wall Street Journal (2024).

⁸ China's Demographic Outlook and Implications for 2035, Economist Intelligence Unit (2024).

⁹ Ellen Zhang & Marius Zaharia, <u>Chinese Graduates Hold Off Career Dreams, Take Temporary Government Jobs</u>, Reuters (2023).

¹⁰ See, e.g., Britt Clennett & Joyce Huang, <u>China 'Ready to Fight' After 3 days of Large-Scale Military Drills Around Taiwan</u>, ABC News (2023).

¹¹ Nick Danby, <u>China's False Promise: Gunboat Diplomacy. Not Win-Win Outcomes. Will Shape the South China Sea</u>, Journal of Indo-Pacific Affairs (2022).

¹² Hudson Lockett & Joseph Cotterill, <u>'Uninvestable': China's \$2th Stock Rout Leaves Investors Scarred</u>, Financial Times (2024).

¹³ Steve Gutterman, <u>How The Kremlin Stands To Gain From Iran's Attack On Israel - Analysis</u>, Eurasia Review (2024).

¹⁴ Aamer Madhani, <u>U.S. Intelligence Shows China Is Surging Equipment Sales to Russia to Help War Effort in Ukraine, AP Says</u>, PBS NewsHour (2024); Angelo Amante, <u>G7 Warns Iran Not to Give Russia Ballistic Missiles for Ukraine War</u>, Reuters (2024); Christy Lee, <u>North Korean Missiles Used by Russia Against Ukraine Are Products of Sanction Loopholes</u>, Voice of America (2024).

¹⁵ <u>How China and Russia Use Information Operations to Compete with the US</u>, CNA (2023); Steven Lee Meyers & Sheera Frenkel, <u>In a</u> <u>Worldwide War of Words, Russia, China and Iran Back Hamas</u>, New York Times (2023).

China, Russia, and Iran's approaches toward the countries of the so-called Global South bear significant similarities: manipulating anti-colonial sentiments, criticizing democracy as inferior to the authoritarian model of government, and leveraging the host-nation's economic and governmental vulnerabilities to gain a tactical foothold and parlay it into strategic influence.

Why We Need a New Vision for Competitiveness

The geopolitical and technological imperatives of the emerging international landscape demand a grand strategy, one that harnesses the transformative potential of AI and other emerging technologies. We must prepare, invest, and organize for the arrival of increasingly powerful AI, including Artificial General Intelligence, while being mindful that its exact definition is evolving alongside the maturation of AI capabilities. The United States' current leadership in generative AI and AI-related technologies is commendable, but by no means guarantees an enduring advantage. Other nations recognize the transformative potential of AGI for national security, economic prosperity, and global influence, and will undoubtedly strive to be the first to achieve it. The United States must also mobilize, along with our allies and partners, against the sustained attacks against the world order. Managing crises is no longer sufficient, and the constant red-teaming of risks of escalation is counterproductive. To face the present challenge head-on, we must renew our strategic confidence and competence.

This Vision for Competitiveness is our proposed strategy on how to do that in concert with our allies. It seeks to bolster national strength, strengthen alliances, rebuild deterrence, catalyze American prosperity, and ensure our leadership in the coming era of Al-driven technological innovation. Success between 2025 and 2030 is critical; only a decisive strategy can seize the moment and rejuvenate confidence in our institutions, fortify global leadership, and secure national interests for decades to come.

Our nation and its citizens are confronted with critical challenges that have the potential to irreversibly shape the future of not just our country, but civilization as a whole. These issues are pressing and demand immediate attention. It is imperative that we muster the courage and resolve to make novel and consequential decisions that will determine the fate of our nation and the free world.

Purpose of the Document

• To identify the primary challenges and opportunities confronting the United States and the rapidly evolving global order within the next five years, driven by advancements in AI and other emerging technologies, and intensifying geopolitical threats.

- To articulate the fundamental goals that should guide a bipartisan response to these complex challenges, ensuring continued leadership in AI and emerging technologies while navigating their transformative impact on national security, economic competitiveness, and global affairs.
- To put forth a conceptual foundation and guiding objectives for the development of effective national policies, strategic decisions, and investments in AI and emerging technologies that will ensure victory in an evolving, technology-driven geopolitical landscape.

While the purpose of this Vision for Competitiveness is ambitious, this document is not intended as an allencompassing grand strategy that sets forth overarching U.S. national objectives and means to orchestrate all levers of national power. Rather, it is a technology-first vision for how the United States, working with allies and partners, can master the next wave of innovations, prevail in the existential competition with China and the other members of the Axis of Disruptors, and secure the future.

The Fundamental Purpose of the United States

The United States was founded on the ideals of individual liberty, the rule of law, the competitive market, self-determination, and the pursuit of a better life. Our core purpose remains to uphold these ideals at home while defending them against attacks from abroad. Domestically, this hinges on preserving the legitimacy of our political processes and institutions, and a shared belief that the government — at all levels — seeks not to hinder, but rather to unleash and aid as necessary, the potential of its citizens and private enterprises. Internationally, it hinges on the existence of a relatively peaceful and predictable order, one governed by rules not dictated by might, and one that aspires toward freedom and democracy, not autocracy.

However, the current global order faces existential challenges from competing ideologies — authoritarianism chief among them — and actors who prefer anarchy in which they believe they can thrive and impose their will. Our goal should be to strengthen and preserve the current order, which strives to foster freedom, peace, and prosperity for all. Maintaining order requires avoiding complacency, both our own and that of others. However, our true global influence lies in pioneering new frontiers and extending access to those advancements to the world.

While America is a grand experiment in democracy, it is not without its challenges: our government is slow, often internally divided, and not inherently optimized for concerted global competition. Yet during the Cold War, new and innovative institutions arose to partner with and complement our private sector in order to counter and ultimately defeat the Soviet threat. Our ability to adapt and improve has historically served as a source of national strength and resilience. The rise of AI and the coming technological transformation offers tremendous potential for amplifying not merely the appeal and influence of freedom and prosperity, but also for bolstering our national defense for a more secure future for ourselves and our allies. The United States may not yet be fully prepared for this new technological era, but we have shown that our nation has the dynamism to adapt and excel. The responsibility now lies with America's leaders to ensure that we do.

Political Strength. Today's hyper-partisanship and polarization is straining our political system, but America's enduring political strength lies in its system of checks and balances. The Founding Fathers, wary of overly concentrated power in a single institution or individual, designed a government where the legislative, executive, and judicial branches share and constrain each other's authority. This system, while prone to slowness and occasional gridlock, ensures that no single individual or faction can exercise power arbitrarily. It demands compromise, ensures that no one is above the law, protects minority rights, and provides a mechanism for the peaceful transition of power. Taken together, these checks and balances lend stability to our political system but also enable our democracy to evolve and change, thus ensuring its health and vibrancy.

Another enduring strength is the resilience of its democratic institutions and the wide belief in their legitimacy. The Constitution acts as a bedrock, providing continuity even in times of polarization. While civic participation and trust in institutions may wax and wane, Americans by and large remain committed to the founding principles of our nation and our liberty. This commitment creates a reservoir of political legitimacy that endures beyond specific leaders or policies, ensuring continuity amid internal disputes and external challenges.

Economic Strength. The United States has the world's largest economy, with a nominal GDP of approximately \$27 trillion as of 2023 — more than a third larger than its closest rival, China.¹⁶ America's massive and highly diversified economy boasts strengths in services, software, biotechnology, and many other cutting-edge industries, as well as traditional sectors like finance, agriculture, and energy, critical not only for growth but also for economic security. America is a global leader in innovation, a significant investor in research and development, and a magnet for foreign capital and talent that fuel the creation of new businesses, products, and services which in turn drive economic growth and set the pace for much of the world.

The United States is also the world's financial superpower: the U.S. dollar serves as the global reserve currency, underpinning international trade and finance. This unique status grants America significant economic leverage, prosperity, and financial stability. Additionally, the United States is home to the largest, most sophisticated, and most liquid financial markets in the world, promoting two-way capital flows and providing businesses at home and abroad access to funding for expansion and innovation. Its workforce, while facing challenges,¹⁷ is still growing and remains highly skilled and productive, a byproduct of having the best universities and top talent from around the world.

Military Strength. The United States possesses the world's most professional, powerful, and technologically advanced military, led by some of the most combat-hardened leaders in the world. With a budget exceeding those of the next ten largest militaries combined,¹⁸ an unmatched worldwide presence, and weapon platforms of superior and reliable quality, its armed forces have a peerless global reach. The United States maintains a significant network of overseas bases and alliances, allowing for rapid deployment, staging, and power projection in strategic regions across the globe. Its military

¹⁶ Compare the U.S. nominal GDP in 2023 (\$27.36tn) to China's (\$17.66tn). See <u>World Economic Outlook (April 2024) - GDP, Current</u> prices, International Monetary Fund (2024).

¹⁷ As of February 2024, "data shows that we have 9.5 million job openings in the U.S., but only 6.5 million unemployed workers." See Stephanie Ferguson, <u>Understanding America's Labor Shortage</u>, U.S. Chamber of Commerce (2024).

¹⁸ Dave Lawler, <u>U.S. Spent More on Military in 2022 Than Next 10 Countries Combined</u>, Axios (2023).

leverages cutting-edge technology across all branches and in each domain, from AI, cyber, and space capabilities to advanced air, ground, and naval platforms.

America's military dominance also rests on its nuclear deterrent capabilities: a vast and reliable nuclear arsenal that serves as a major check against adversaries and a key assurance for our treaty allies. Additionally, the U.S. defense industry is the undisputed leader in global technological and weapons development and exports, driving innovation in areas that often spill into broader civilian applications. While costs and strategic focus are subject to debate, the vast capabilities of the U.S. military are a formidable, central component of its position as a global superpower.

Innovation Strength. The United States maintains a dominant position as a global technology powerhouse. The country is home to Silicon Valley, multiple existing and emerging innovation hubs, and a nationwide network of research labs, which together foster an ecosystem of innovation, attract large-scale venture capital, and engender a culture of balanced risk-taking. American universities and national labs excel in research and development, while a skilled workforce fuels a robust knowledge economy. This combination drives advancements in cutting-edge fields like AI, biotechnology, quantum computing, advanced networks, next-generation energy, and advanced manufacturing. Two recent, history-making accomplishments have demonstrated America's leadership in innovation: the expeditious development and scaling of COVID vaccines, and incredible advances in generative AI.

American tech giants also continue to hold vast market power and influence, impacting global communication, commerce, and entertainment. The strength of the tech sector attracts top talent from around the world, further reinforcing American technological leadership. While facing increased competition, particularly from China, America's innovation infrastructure and entrepreneurial spirit remain powerful drivers of technological advancement and a tremendous source of national power. In a world in which America's military and diplomatic power may increasingly be contested, the decisive advantage for the United States may come from its innovation power.

Background of the Present World Crisis: The Existential Challenge of the Axis of Disruptors

While America's strengths remain commanding, the international geopolitical environment is becoming increasingly more strained, complex, and competitive. Two principal phenomena are driving these dangerous changes. The first is the growing assertiveness of and (tacit) coordination among China, Russia, Iran, and North Korea. The second is the rapid advancement of new technologies, principally (but not exclusively) AI, that is acting as a catalyst for disruption and realignment.

The "Axis of Disruptors" — China, Russia, Iran, and North Korea — united in their disdain for the American-led, rules-based order, appear to sense an opportunity to stress this order through simultaneous, disruptive actions and push it to a breaking point.¹⁹ The alignment of these revisionist powers is less of an ideological bloc and more a marriage of convenience born out of their intent to end the current international order. Their methods include imposing absolute control at home, and engaging in cyber interference, economic coercion, military aggression, and other nefarious actions abroad. This diffuse but sustained challenge chips away at the foundations of the international order, not through grand victories, but constant pressure, and with incremental gains near the threshold that would provoke America's full fledged reaction.

While their ultimate ends may not be fully aligned, there is considerable commonality in the objectives that they pursue. Politically, all four nations seek to weaken democratic alliances in Europe, the Middle East, and Asia; support existing and emerging anti-United States regimes worldwide; advance false narratives to discredit the United States, its allies, and democracy at large; and promote an alternative, authoritarian form of government and world order rife with lofty slogans, but short on substantive principles. Economically, they seek to weaponize their endowments of natural resources, particularly fossil fuels and critical minerals, while moving to control natural resources in developing economies around the world. They leverage direct investments and corruption to co-opt local elites, take over

¹⁹ <u>3 Key Takeaways from 2023 & 6 Items to Watch in 2024</u>, Special Competitive Studies Project (2023).

infrastructure assets, and foment political instability to create lasting dependencies. They seek greater sway in existing international economic institutions by leveraging decision-making processes of such institutions to get their way or bring them to a standstill, all while promoting alternative institutions which they claim would be more equitable and fair. They may decry centuries-old acts of economic exploitation against them — many of which are vastly distorted and exaggerated — but make no mistake: they simultaneously engage in 'brute force' economics, devastating cyber attacks, and massive heists of intellectual property.

Militarily, they are each other's security partners of choice. They collaborate and assist one another in developing strategic weapons, share insights on how to defeat American and allied defenses and weapons platforms, and often cooperate in circumventing international sanctions. All four have perfected and leverage extensive military and intelligence operations that directly challenge American and allied interests without provoking an all-out war. Over time, these nefarious actions continuously raise the level of what becomes tolerable, even if not acceptable, and in the process erode American political will and credibility and undermine international peace and security. While their level of distrust toward one another remains strong and inhibits them from entering into formal alliances, their military partnerships have been gaining depth. China, Iran, and North Korea have all provided decisive military aid to Russia to sustain its war of aggression against Ukraine. Bilaterally and even tri-laterally,²⁰ they have engaged in joint military exercises with other like-minded nations in observer status. Military technology transfers have been an ongoing phenomenon for decades; the latest transfers include drones and drone components, missiles, and semiconductors.²¹ In intergovernmental organizations, they provide diplomatic cover to one another for sanctionable military activities and, when compelled to act against each other, use diplomatic capital to water down condemnations and sanctions. They also maintain robust relationships with each other's proxies and client states, providing them with a degree of international legitimacy, foreign aid, and material assistance.

With respect to innovation, all four prioritize absolute control over their domestic information domains and aspire to develop technological self-sufficiency. They also engage in cyber attacks to gain intelligence, economic insights, and technological know-how, as well as to lay the groundwork for future attacks. They engage in disinformation campaigns through digital platforms that aim to blur the line between fact and fiction, weaponize socio-economic fault lines to sow discord, and instigate crises during politically charged election periods. They have a zero-sum view of space exploration, preferring to hold the entire domain at risk than to cede it to American preeminence, and often use space programs as cover for developing long-range missiles. In short, innovation is viewed as another means to increase control, assert state power, and reshape the international order. Therefore, the preference is for indigenous innovation, first and foremost, and for foreign-developed, but domestically repurposed

²⁰ <u>Russia, Iran and China to Hold Warship Drills in Gulf of Oman</u>, Reuters (2024).

²¹ Demetri Sevastopulo, et al., <u>US says China is Supplying Missile and Drone Engines to Russia</u>, Financial Times (2024).

second. But they do not exclude leveraging foreign innovations for foreign policy objectives, even if simultaneously denying access to such innovation to their own populace. In an ideal world, all four prefer a fragmented innovation ecosystem that allows them unfettered access to all, but denies others access to theirs.

Technological Trends

The Next Generation AI Pathways

In the second half of this decade, innovative AI capabilities will come from a constellation of closed proprietary²² and open-source models. The release of ChatGPT, a proprietary generative AI model,²³ in November 2022 was for many their first encounter with an actual AI system. On account of its relatively simple user interface and its general-purpose capabilities, it quickly amassed more than 100 million users and solidified AI's place as a revolutionary technology.²⁴ Since then, there has been a surge of AI model development and adoption, as well as applications built on top of the foundation models to advance manufacturing, biotechnology, education, and defense.²⁵ Leading these efforts are well-resourced companies and countries that leverage massive datasets, vast computing power, and cutting-edge research to cultivate proprietary AI models with exponentially greater capabilities.

Meanwhile, the rise of open-source AI models has enabled the diffusion of multi-purpose AI capabilities among a wide variety of actors. Within open-source models, there is a spectrum of "openness": for example, individual aspects or some combination of code, data, architecture, and licensing arrangements can be open-source.²⁶ In certain historical contexts, open-source technology has been a democratizing force, expanding access to knowledge and tools. As a driver of startups and academic research, it is a competitive advantage of the U.S. innovation ecosystem. Open-source AI models thrive on community-driven innovation, fostering collaboration, transparency, and accessibility. Open-source

²² "Proprietary AI refers to artificial intelligence technologies developed and owned by specific companies, often made available to customers through licenses or subscription services." See <u>Open Source vs. Proprietary AI: A Comparative Analysis</u>, Medium (2023). ²³ "Generative AI is a category of algorithms that finds patterns in training datasets and extrapolates from them to generate content such as text, images, or audio, given natural language or multimedia input." See <u>Generative AI: The Future of Innovation Power</u>,

Special Competitive Studies Project at 31 (2023).

²⁴ Krystal Hu, <u>ChatGPT Sets Record for Fastest-Growing User Base - Analyst Note</u>, Reuters (2023).

²⁵ The State of AI in 2023: Generative AI's Breakout Year, McKinsey (2023); Lauren Coffey, <u>Harvard Taps AI to Help Teach Computer</u> <u>Science Course</u>, Inside Higher Ed (2023); Sydney J. Freedberg Jr., <u>Pentagon Tested Generative AI to Draft Supply Plans in Latest GIDE</u> <u>9 Wargame</u>, Breaking Defense (2024).

²⁶ On one end of the spectrum, fully open-sourced models may release their weights and code, thereby giving insight into the inner workings of the model; on the other end, models might be accessible only through an API with no access to the underlying model. Inbetween are various levels of partial openness, including models with published architecture and training code, but unpublished weights. See Zoë Brammer, <u>How Does Access Impact Risk? Assessing AI Foundation Model Risk Along a Gradient of Access</u>, Institute for Security and Technology (2023).

model capabilities, however, can be expected to continue to lag behind proprietary frontier models, primarily due to economic and technical constraints on scaling.

For all their upsides, powerful open-source AI models also entail risks. One of the downsides is giving up the ability to update, constrain, monitor, and withdraw the model if safety concerns emerge following its deployment. Once a model's weights are released, it is relatively easy to modify, fine-tune to bypass safeguards, or combine with other models, making it impossible to maintain control over the model or its downstream use.²⁷ The decentralized implementation and development spurred by open-source models could open the door to misuse by adversaries and other malicious actors.

In the remaining years of this decade, we can expect to see rapid advancements in both proprietary and open-source AI models. United States policymakers will need to continue to monitor and govern proprietary AI advancements. At the same time, we need to find ways to effectively govern open-source AI without impairing our own ecosystem's ability to leverage it. Over-regulating open-source initiatives can stifle domestic innovation and leave the United States at a disadvantage compared to our geopolitical competitors who may not be bound by similar regulatory constraints.

Moreover, ensuring the United States fosters a technology ecosystem with the right balance of proprietary frontier and open-source AI models will have geopolitical implications. Only a very small number of countries and companies possess the resources to develop frontier foundational AI systems. A few will be able to marshal the resources to create these AI systems to solve cutting-edge challenges, but others may have to rely on moderately advanced open models at a fraction of the cost with greater flexibility. Most actors on the global stage will face a tradeoff between power, when using someone else's closed model, and freedom, when building on top of relatively less capable open-source models. The United States' AI policy will have to account for both of these trajectories.

The Road to AGI

Based on advances across the AI stack, including improvements to hardware and algorithms, we can expect future generations of AI models to progress toward more generalized and powerful capabilities. Market demand and the direction of current research are pointing toward the advent of agentic AI that can take actions in pursuit of complex, human-directed goals. There may not be a single development that results in Artificial General Intelligence (more on this below), but cumulative progress will likely result in agentic AI that will have certain characteristics: namely, some combination of goal-directedness, longer-term memory, and tool use/ability to take actions and create and carry out plans. AI models

²⁷ Note there is ongoing research into watermarking model weights to help trace where open-source software originally came from (tracking the system, rather than the outputs) and projects focused on preventing model weights from being further tuned. See Simon Lermen, et al., <u>LoRA Fine-tuning Efficiently Undoes Safety Training in Llama 2-Chat 70B</u>, arXiv (2023).

already have multimodal capabilities that can learn from and process different types of data — text, image, audio, video — allowing for more than language inputs and outputs.

Over the next few years, we will also likely see AI tools that can process more and more information at once, allowing them to have short-term memory across massive amounts of input,²⁸ even more so than current LLMs. This capability allows an AI to learn at the time of prompting ("in-context") from input tokens, recall significantly more information, and reason across data in a prompt.²⁹ Longer context windows enable users to create specialized models — by inputting large amounts of task-specific data at the time of query — without needing to retrain the model.³⁰ They also allow AI models to have a sort of memory that enables AIs to create and follow plans in the pursuit of longer-term goals. AI can already use digital tools like calculators, web browsers, coding environments, and digital marketplaces. These tools — which are quickly expanding in scope and sophistication — allow AI to autonomously interact with, impact, and learn from the real world. In time, these task-specific AI agents might be able to interact with one another, but more research is needed on the potential of such possibilities.³¹

Humans will be able to leverage these AI agents to take action using natural language, including to find solutions to pressing problems. When this is available to humans at large, the world will be forever transformed. Humans will be able to employ AI agents that can, for example, write code to take complex actions in the real world.³² Moreover, the combination of scale, multimodality, and real-world reinforcement learning could lead to one or more centralized model(s) with general capabilities in virtually all tasks, based on knowledge that exceeds all of humanity — a threshold which some consider to indicate Artificial General Intelligence (AGI).³³ The development of AGI could offer never-before-seen benefits, such as the ability to solve critical scientific hurdles by expanding the pool of cognitive labor,

³³ Sam Altman, <u>Planning for AGI and Beyond</u>, OpenAI (2023).

²⁸ Context windows have been getting longer, and this work could lead to continuous context windows in which AI has significant short term memory; however, this area remains a novel challenge. See Machel Reid, et al., <u>Gemini 1.5: Unlocking Multimodal Understanding</u> <u>Across Millions of Tokens of Context</u>, Google DeepMind (2024).

²⁹ For example, the entire grammar manual for a specific language and some examples of sentences in that language can be fed into a context window, and the AI model can learn to translate text from English into that language at a level similar to a person learning from the same content. See Chaim Gartenberg, <u>What is a Long Context Window?</u>, Google The Keyword (2024).

³⁰ Fine-tuning (further training of the model on a possible set of tasks) and prompting (particularly with longer context windows) are two independent ways to make a specialized model. Developers of closed AI models can fine-tune their own models to create specialized models via further training. However, for closed-source models which are not publicly available to fine-tune, a longer context window provides a mechanism for third parties to fine-tune the model in effect. Open-source models can both be fine-tuned and employ long context windows.

³¹ When agents can talk to each other and the authors of their respective systems are different, the ensuing consequences could be catastrophic, in cases of unstable interaction dynamics. We expect that terms of service and licensing agreements, at least initially, will prohibit this interaction. However, well-constructed agent-agent interactions could be beneficial for problem-solving and quick iteration.

³² Progress toward AI that can execute action is supported by work integrating foundation models with robotics to enhance a robot's ability to understand and respond to complex commands and environments. See for example, <u>Figure Status Update</u>, Figure AI (2024); <u>NVIDIA Project GR00T</u>, NVIDIA (2024).

and to make humanity ever-wiser by providing us with an improved level of information gathering, communication, and education.

In the evolving discourse on AGI, the United States must ensure that our preparation for and response to AGI adheres to our values, laws, and ethical frameworks. At the same time, recognizing that our main geopolitical competitors aim to reach the "commanding heights"³⁴ of technological innovation before the United States, it is imperative that the AGI narrative does not predominantly focus on the risks. We must not lose sight of the urgency to bolster our competitiveness, increase the prosperity of our people, and propel our country into the future. If some form of AGI is approaching, the arc of history will bend toward the nations that have understood its potential and have taken appropriate action to prepare for it. The United States has historically marshaled the collective resources of academia, government, and the private sector when the moment has demanded it - such as our mobilizations during the Manhattan Project, the Space Race, the development of the Internet, and the rapid rollout of COVID-19 vaccines. Indeed, our nation's most ambitious technological achievements have resulted from united national efforts in technological advancement. To maintain global leadership and secure our interests and those of our allies, the United States must proactively shape, develop, and deploy AGI through a comprehensive strategy that integrates the strengths of our entire nation. This approach will not only ensure that we stay at the forefront of technological innovation, but also enable us to shape the governance frameworks that will guide the global deployment of AGI, ensuring its alignment with democratic values and international norms.

Al's Convergence with General Purpose Technologies

This decade is marked by both the advancement of multiple general-purpose technologies and their convergence. A new wave of general-purpose technologies — Al, advanced networks, compute, biotechnology, next-generation energy, and advanced manufacturing — are emerging. Like the general-purpose technologies that came before them — from steam power and the telegraph to aviation, mass production, and the Internet — they have a wide range of applications across industries and hold the potential to unlock outsized economic and geopolitical benefits.

Al's acceleration of these general-purpose technologies will further distinguish this technological era by transforming the very process of innovation.³⁵ While the past several decades of technological change took place primarily in the digital domain, Al and other emerging technologies are unfolding across the physical, digital, and biotechnical domains.

The convergence of these technologies will create new opportunities and unexpected problems that will need to be solved. For example, the convergence between the physical and digital domains allows for the

³⁴ <u>Full Translation: China's 'New Generation Artificial Intelligence Development Plan' (2017)</u>, DigiChina (2017).

³⁵ <u>Generative AI: The Future of Innovation Power</u>, Special Competitive Studies Project at 61 (2023).

creation of intelligent factories that produce goods in a much more flexible and efficient way. These digitized facilities, however, can also be expected to be much more vulnerable to cyberattacks. Programmable biotechnology will enable personalized healthcare, biomanufactured infrastructure, and more. At the same time, it also risks lowering the barriers to entry for the creation of bioweapons.

Global technology leadership will accrue to the nation(s) best able to harness technological convergence across multiple domains. The leadership of the United States in AI will be necessary but insufficient to unlock the innovation power required to lead in this era. Five other technology battlegrounds — and their convergence with AI — will help shape the geopolitical terms and the destiny of nations in this decade and the next:

- Biotechnology. Biotechnology promises the unique opportunity to grow and manipulate the essence of life as we know it. Applying AI to nature's source code DNA will make the research and development of drugs, foods, and the fermentation of industrial chemicals faster, cheaper, and more accessible. Yet high-quality data will be an essential input for AI-enabled biotechnology, and a limiting factor for the ability to engineer biology. The United States is entering this race with an early lead in terms of innovation, investment, and talent, but public-private partnerships will be necessary to outcompete a determined PRC and secure a "biofuture" that neither the U.S. Government nor industry could achieve alone.³⁶
- Advanced Networks. Harnessing the value from AI in real-world situations hinges on the ability to rapidly and reliably transmit data between machines with a latency measured in nanoseconds. Emerging advanced networking standards like 5G advanced, WiFi 7, and 6G will unlock long-anticipated applications like autonomous vehicles, remote human-machine teaming for healthcare, and software-defined intelligent factories. The PRC won the race to deploy commercial 5G networks globally. But as nations and firms compete to shape standards and deploy next-generation networks that underpin cyber-physical systems, the outcome has yet to be decided.³⁷
- Advanced Compute & Microelectronics. Continued compute scaling has underpinned rapid progress in AI over the past decade, but Moore's Law the prediction that available compute power would double every two years faces an uncertain future. Compute and energy demand from AI scaling continues to far outstrip the gains from Moore's Law, creating a bottleneck that threatens AI progress. Scaling breakthroughs in novel computing architectures and post-Moore's Law microelectronics such as in-memory computing, reversible computing, and superconductor electronics would open new possibilities.³⁸

³⁶ National Action Plan for U.S. Leadership in Biotechnology, Special Competitive Studies Project (2023).

³⁷ National Action Plan for U.S. Leadership in Advanced Networks, Special Competitive Studies Project (2023).

³⁸ National Action Plan for U.S. Leadership in Advanced Compute & Microelectronics, Special Competitive Studies Project (2023)

- Next-Generation Energy. The global energy sector is undergoing a massive transformation. Clean energy technology is now central to the global techno-economic competition, as nations pursue new ways to power their technological advancement while energy innovations converge with AI, compute, transportation, manufacturing, and other strategic sectors. The United States must catalyze disruptive innovation in technologies like energy fusion, space-based solar power, and long-duration energy storage in combination with policy measures to create new national security, economic, and diplomatic advantages.³⁹
- Advanced Manufacturing. A core set of emerging technologies, from AI to additive manufacturing and robotics, are converging to transform how things are made. These technologies harness the United States' advantage in AI and software to create production systems that are faster, cheaper, and more sustainable. Accelerating the deployment of advanced manufacturing systems could chip away at China's manufacturing dominance and bolster the United States' capacity to restore its industrial base.⁴⁰

Progress across each of these general-purpose technologies either builds on or enables transformative change in Al.⁴¹ As states seek to capture the strategic and economic benefits of general-purpose technologies, emerging sectors have become battlegrounds where strategic competition plays out. Commercial competition notwithstanding, the race to shape technological convergence ultimately breaks down across geopolitical and ideological lines. The outcome of this competition will determine whether these technologies are shaped in accordance with democratic or authoritarian values.

³⁹ See <u>National Action Plan for U.S. Leadership in Next-Generation Energy</u>, Special Competitive Studies Project (2024).

⁴⁰ National Action Plan for U.S. Leadership in Advanced Manufacturing, Special Competitive Studies Project (forthcoming).

⁴¹ For example, scientists are building large-scale models trained to understand the language of biology. Generative AI is being used to design AI chips used to power future compute advancements. In energy, scientists are leveraging generative AI for projects that range from designing novel high-performance battery materials to stabilizing fusion reactors — all in a race against time to usher in a new paradigm of abundant, low-cost energy that will, among other things, support future AI scaling. The convergence of novel and existing forms of AI with other general-purpose technologies has contributed to the development of advanced manufacturing technologies.

Vision for Competitiveness

What Does Winning Look Like?

Most Americans alive today have only known a world in which freedom is the destiny of each nation, democracy rather than autocracy provides the best model to organize societies, and technological innovation is intended to improve rather than reduce human welfare. In our 2022 report on the Mid-Decade Challenges to National Competitiveness, we outlined how all three of these propositions could be compromised.⁴² Specifically, we described what losing the technology competition to the People's Republic of China would look like. In this scenario, China dominates the economy of the future and captures the trillions of dollars in value generated by the next wave of technologies; China's tech sphere of influence spans the globe; authoritarianism emerges as the dominant ideology, with democracy in retreat; the Internet is fractured, with digital oppression replacing digital freedom; each nation's digital infrastructure is compromised; the U.S. military's technological overmatch is lost; and our nation's access to microelectronics and critical tech inputs is jeopardized. In sum, we would witness the unraveling of the order that the United States and the free world painstakingly built after World War II and protected throughout the existential challenge of the Cold War.

In this report, **we seek to outline what winning looks like** and, specifically, why prevailing in the technological competition is the *sine qua non* of victory. First, we maintain that the road to winning begins with restoring our strategic confidence. Handwringing, risk aversion, and self-doubt will neither inspire our friends nor intimidate our adversaries. We are the nation that split the atom and sent the first human to the Moon. We connected the world with the Internet, enabled humanity to exit the COVID-19 pandemic, and are now ushering in the age of artificial intelligence. We can surely be the country that leads in biotechnology to cure terminal diseases, in developing new sources of energy that both power and protect our planet, in designing and deploying new compute and networking paradigms that protect the flow of data and enable future discoveries, and in modernizing manufacturing to eliminate supply chain risks and rebuild the arsenal of democracies.

Second, we must adapt to the changing nature of power. Military, diplomatic, economic, and soft power have been essential to our past successes. But as our primacy is contested, there is an opportunity and a

⁴² <u>Mid-Decade Challenges to National Competitiveness</u>, Special Competitive Studies Project (2022).

necessity to master a new form of power: innovation power.⁴³ For it is innovation power that plays to our greatest strengths — the freedom to think, to research, to experiment, and to associate — and it is innovation power that will determine our resilience and provide the decisive edge in the competition.

Third, we need to unabashedly stand up for, rebuild, and defend a global order characterized by freedom, openness, democracy, and the rule of law. This order gave humanity its longest stretch of peace, security, and prosperity. There are more democracies than autocracies, and more who cherish freedom than the yoke of tyranny. While not everyone may embrace this order, those who seek to weaken it should be decisively contained, their autocratic visions publicly discredited, and their asymmetric access to the current order curtailed.

So, what does success look like? If we are to prevail, democracies would be home to the greatest prosperity and incubators of economies of the future. They would be free of supply chain vulnerabilities, both physical and digital. The relentless pursuit of technological innovation would offset adversaries' military investments, deterring them from aggression and greyzone attacks. The digital domain would be open, free, and resilient, with malicious cyber and disinformation attacks relegated to the dark corners of the Internet. Data flows would facilitate the exchange of knowledge and insight, instead of enabling repression. In sum, we would witness a resumption in the building of the order that is at peace with itself, while effectively isolating the existential challenges to its stability, prosperity, and way of life.

What Courses of Action are Plausible?

At the most general level, there are three plausible courses of action that the United States can follow today. They are:

- 1. Continuation of the Present Course;
- 2. Disengagement and Isolation; and
- 3. Mobilization of the Technological, Economic, and Military Strength of the Free World.

Course of Action 1: Continuation of the Present Course

This section analyzes the present course that began in 2017 and has persisted across two different U.S. presidential administrations, and discusses actions already taken, the outcomes thereof, and the

⁴³ Eric Schmidt, <u>Innovation Power: Why Technology Will Define the Future of Geopolitics</u>, Foreign Affairs (2023)

potential risks associated with continuing upon this path. This is the policy that identified and, for the most part, treated China as the pacing threat and Russia as the most erratic disruptor.

Political Aspects. Since the strategic realignment toward great power competition in 2017, the United States has secured a number of important foreign policy advantages. Through the efforts of two successive administrations, the United States has demonstrably strengthened its network of international alliances and partnerships. This is evidenced by the establishment of the Quadrilateral Security Dialogue (the Quad), the AUKUS agreement, the enhanced trilateral partnership with Japan and the Republic of Korea, and the expansion and investment in the North Atlantic Treaty Organization (NATO). Yet despite these accomplishments, they have proven insufficient to stem the rise of tension and conflict throughout the world. Russia ultimately was not deterred from attacking Ukraine. It aggressively targets the United States and other democracies with malign influence activities, including continued attempts to interfere in elections. More recently, Iran became the first state to directly attack Israel in over three decades, while its proxy forces in Yemen have succeeded in imperiling maritime activity in the Red Sea.

The continuation of current policies in an increasingly unstable security environment — and the associated failure to re-establish deterrence — would risk greater geopolitical tension and undermine existing alliances. An emboldened China would continue to attempt to redefine the status quo on Taiwan to its liking, harass the Philippines, and undermine global rules and norms. Iran and North Korea would continue to expand their nuclear and missile activities, raising the risks of confrontation with the United States and its allies. Iran would continue to leverage its proxies throughout the Middle East to attack the United States, Israel, and the freedom of navigation, and plot to assassinate U.S. officials and Iranian dissidents. North Korea would continue its policy shifts toward the South, including framing their ties as those between two belligerent states. And Russia would continue to attack Ukraine and attempt to turn it into a failed state, while setting its sights on undermining the overall security architecture of Europe.

Economic Aspects. America's economic realignment has also been significant. China's malign trade practices no longer go unnoticed and are increasingly challenged. Chinese investments in strategic sectors of the U.S. economy are more diligently scrutinized, and nascent efforts to similarly screen outbound investments are underway. Our allies are also taking steps to address Chinese malign trade practices. Domestically, the administration and Congress have pivoted to emphasizing industrial policy, with investments in America's infrastructure, manufacturing base, clean energy, and semiconductors. There is significant support for re-shoring, and greater acknowledgment of the importance of manufacturing for the American economy. While this realignment has been beneficial to U.S. national competitiveness, present policies could leave it unfinished. The weakened architecture of global economic interdependence has not been replaced with a new order that ties the United States more tightly to safer sources of imports — our allies and partners. The continuation of current policies would see the further displacement of Chinese inputs without a corresponding willingness to embrace deeper economic partnership with our allies. As a result, the United States could face higher prices, lower growth, and weaker economic performance.

Military Aspects. The United States has moved to modernize its forces and alliances, despite its readiness coming under pressure due to active hostilities in Ukraine and the Middle East. The end of budget sequestration, which had seriously constrained the Department of Defense's ability to appropriately plan for its missions, was an important step in this regard. Ensuing budgetary expansions have helped, though inflationary pressures on the U.S. economy continue to reduce the impact of larger budgets. The Department of Defense is developing new warfighting concepts that reflect the changes in the character of war and growing Chinese military capabilities. The awakening among allies in Europe and Asia, particularly after the Russian invasion of Ukraine, has bolstered their defense spending and increased their desire for closer partnership with the United States. That being said, the power of American deterrence has eroded in each of the three most consequential theaters of operation: Asia, Europe, and the Middle East. The DoD is still insufficiently resourced to face future great power challenges, and especially simultaneous challenges. While adversaries around the globe engage in unprecedented military-technological modernization, the United States continues to invest in its armed forces as if it were a time of peace. In the event of a multi-theater war, U.S. forces would run the risk of being overpowered. If faced with serious attacks against our homeland, the seams between defense and homeland security would leave us exposed. The war in Ukraine has laid bare the significant challenges of the U.S. defense industrial base when forced to sustain a prolonged conflict, and our inability to supply forces with novel capabilities at scale, such as drones. Deficiencies in U.S. shipbuilding and hypersonic missiles and missile defenses, and the rapid expansion of Chinese nuclear, submarine, digital, and space forces, mean that United States military primacy may well come under severe pressure in the near future.

Technological Aspects. The United States has taken important steps to ensure its primacy and contend with the unprecedented technology competition that it faces from the PRC. Recent policy momentum has increased federal research and development funding, though current levels still fall short of Cold War-levels.⁴⁴ Fortunately, the American innovation ecosystem has repeatedly demonstrated its resiliency and ability to drive global innovation: unique public-private partnerships enabled the United States to rapidly produce the most effective COVID-19 vaccines and end the pandemic. American companies developed the chips and the algorithms that ushered in the generative AI revolution. They are poised to lead the world toward artificial general intelligence and beyond. Lawrence Livermore National Laboratory achieved the first ever demonstration of nuclear fusion ignition, and a number of U.S. private companies are leading the efforts toward commercializing fusion energy among other next-generation energy technologies. America's companies, universities, and labs remain world-class environments for cutting-edge innovators. At the same time, the United States has also found itself on the losing end of some technological advances — such as 5G, electric vehicle batteries, hypersonic missiles, and commercial drones. Most of these losses have not been due to a lack of imagination or invention, but

⁴⁴ Michael E. O'Hanlon & James N. Miller, <u>Focusing on Quality Over Quantity in the US Military Budget</u>, Brookings (2019) ("Relative to the size of the economy, [U.S. defense spending] is down to about 3.5 percent of GDP... During the Cold War, it varied roughly between 5 percent and 10 percent of GDP.").

instead the result of a lack of resources, organization, and proactive policy-making. While they have not necessarily relegated the United States to a permanent follower of technological trends, they have highlighted the necessity of mobilizing our efforts, dedicating resources, and re-thinking the geometry of innovation.

Conclusion. The continuation of current policies presents two primary risks. First, the current approach continues to insufficiently forestall the rise of the Axis of Disruptors and its destabilization of global security. In fact, recent years have witnessed a decay of U.S. deterrence, with a range of states showing increasing willingness to flout global norms. Future failures of deterrence are understandably hard to foresee, but recent global events force us to conclude that current U.S. policies are unable to take us off this trajectory. Indeed, the present course could lead the four disruptors to further deepen their ties and coordinate cascading destabilizations. Second, the current approach — as it continues to fall short — could inadvertently strengthen isolationist and defeatist sentiments in the United States. In doing so, it risks triggering a self-reinforcing loop of withdrawal, destabilization, and retrenchment. As resource demands across the three theaters rise, and as simultaneous crises expose years of underinvestment by our allies, one cannot rule out that the American reaction would be to retreat — which would usher in an era of uncertainty not seen since the 1930s.

Course of Action 2: Disengagement and Isolation

This section analyzes the potential consequences of a shift in U.S. foreign policy toward isolationism. It highlights the anticipated results of U.S. retrenchment across several key aspects: foreign policy, economy, military, and technology.

Political Aspects. A shift in U.S. foreign policy toward isolationism and retrenchment would be severely detrimental to the free world. America's alliance system underpins the security of Europe and East Asia – two regions of greatest consequence to American prosperity. Absent United States support, a revanchist Russia would certainly test NATO's eastern and southern flanks. Moreover, South Korea and Japan — who are heavily reliant on the American nuclear umbrella — would be tempted to develop their own deterrent capabilities. A free and democratic Taiwan without American support is nearly inconceivable. Withdrawing from international agreements and alliances would directly undermine the United States' ability to shape global events and protect its near-term security interests. A United States retreat from world affairs would not just embolden the Axis of Disruptors — it would create a power vacuum that would invite states around the globe to settle disputes by force. It would risk a return to expansionist wars and destroy international norms. Recent events — the conflict between Azerbaijan and Armenia, Venezuela's spurious claims on Guyanese land, and Russia's invasion of Ukraine — show that modern civilization is not immune to such wars. Finally, isolationism erodes the trust and goodwill shared among allies. This jeopardizes cooperation on critical issues like counterterrorism, climate change, and global health, leaving the United States to address these challenges alone.

Economic Aspects. American retrenchment abroad would directly undermine material prosperity at home. Our allies are not only our ideological friends, but also our major economic partners. Imports accounted for 14% of U.S. GDP in 2022, much of which were goods the United States could not easily substitute. Weakening international institutions and diminished trust would herald the return of widespread trade tensions. Unfocused protectionist policies in the United States would lead to retaliation from erstwhile allies, slowing growth and raising prices for American consumers. Geopolitical crises, triggered by a United States withdrawal and an ensuing global economic downturn, could spiral into a much larger economic and political cataclysm. Economic integration with our allies is crucial to the technology leadership that underpins the outcome of the strategic competition. Economic partnerships abroad provide American firms with cheaper inputs and greater demand with which to finance innovation. Lastly, even in the best case, a policy of isolationism would forfeit the United States' role in setting global economic rules and standards, leading to a less favorable environment for American businesses and an overall decline in U.S. economic power.

Military Aspects. The ramifications of isolationism on America's ability to defend itself and project power abroad would be severe. Currently, U.S. security relies on a forward military posture and strong alliances; isolationism would erode this advantageous position, giving adversaries greater leverage to engage in aggression or coercion — and directly threaten American security. Isolationism would cede key spheres of influence, global choke points, and vital maritime lines of communication that enable the free flow of goods and commerce that underpin U.S. economic power. It would undermine the United States' ability to rapidly identify and eliminate security threats as they emerge. It would damage foreign trust in U.S. guarantees and partnerships. And, as recent years have shown, the emergence of adversaries filling the power vacuum would force the United States to return at a much higher financial and human cost. America's best defense has long been its offense — our influence abroad, network of allies and partners, and unifying message of freedom and democracy greatly complement the effects of our armed forces. Under isolationism, the United States would likely face more imposing military threats with fewer resources to address them. In the long run, it would either lead to our defeat — with the United States acquiescing to a global order dictated by its adversaries - or to a costly about-face that demands an unprecedented increase in defense spending to compensate for fewer allies, stronger adversaries, and lost opportunities.

Technological Aspects. Isolationism would most certainly slow down U.S. technological progress. International collaboration fuels scientific and technological advancement. Global instability and declining international cooperation could reduce the flow of foreign capital to the United States, limit the access to foreign talent, and jeopardize supply chains of critical components for technological advances. Just as importantly, withdrawing from global collaboration would inevitably create a vacuum that could allow adversaries and rivals alike to surpass the United States in critical technologies, and consequently undermine our national security, economic competitiveness, and soft power. Without sustained international engagement and presence, the United States would miss critical opportunities to negotiate issues of technological interoperability and standards, and even integration, among trusted allies and partners necessary to bolster our collective security and ensure a strong, free digital ecosystem. **Conclusion.** If the United States embraced a full-blown isolationist policy, it would lead to major political, security, and economic shocks to our country and the world. U.S. retrenchment would create a void that China, Russia, Iran, and North Korea would readily exploit. Without the alliance system, the security of both Europe and Asia would quickly become endangered, undermining freedom around the globe and prosperity at home. As importantly, without U.S. leadership, international norms would decay — further destabilizing the world. To retreat from global leadership would be to weaken the United States' ability to shape international institutions and rulemaking, giving adversaries greater power to promote policies that benefit them at the expense of U.S. interests. Without American leadership, dictators would tout the presumed superiority of their authoritarian regimes with ease, jeopardizing the causes of democracy and human rights — core commitments underlying U.S. national security.

Course of Action 3: Mobilization of the Technological, Economic, and Military Strength of the Free World

Continuing on the present course or retrenching into an isolationist posture could have dire consequences for the United States, its allies and partners, and the world. At the same time, it is clear that we operate in a fiscally and politically constrained environment. Therefore, a successful strategy must construct a path that effectively rebuilds deterrence against the Axis of Disruptors, strengthens the existing economic, diplomatic, and military prowess of the United States and its partners, and harnesses the power of future technology as a new offset.

Fortunately, the United States stands at the dawn of a new era defined by rapid technological innovation and in particular the potential of artificial intelligence. The immense promise of these systems and dangers posed by our adversaries mean that this is not a moment for trepidation, but for bold vision and decisive action. The United States can and must adopt a strategic framework that seizes this moment, using it to ensure America's continued prosperity and global stability. Such a framework should feature three key pillars.

Pillar 1: Reimagine the Endless Frontier. American global leadership will stand or fall on its innovation power. Our leaders must position the nation to spearhead efforts to explore the frontiers of AI and emerging technologies. This requires creating and executing national programs for U.S. leadership, supporting and funding an expansive innovation ecosystem, building a new form of public-private partnership around an ambitious national technology strategy, and modernizing our governing institutions for the innovation age.

Furthermore, by articulating a united vision and by presenting a concrete and coherent strategy that allows us to lead in fields like next-generation AI (including AGI), biotechnology, advanced networks, advanced computing, next-generation energy, and advanced manufacturing, we can supercharge our economy and ensure that these transformative technologies are harnessed for the cause of freedom.

Pillar 2: Restore Peace and Security through AI and Emerging Technologies. With adversaries increasingly intent on upending the world order, the United States has a vital role to play in upholding peace, security, and democratic principles. AI and other emerging technologies will offer powerful tools to enhance our capabilities across the board. But relying on technology alone will not be enough. In order to meet our objectives, we must also fortify our alliances, strengthen and fund our military, revamp our intelligence services, build new partnerships, and create international forums to address the complex challenges posed by emerging technologies. Modernizing our military and diplomatic capabilities will ensure America maintains its global leadership role.

Pillar 3: Catalyze Enduring Economic Advantage in the AI Era. Economic performance is the bedrock of our national strength and global influence. The AI era presents unprecedented opportunities for economic growth, job creation, and societal advancement. By leveraging our innovation ecosystem, entrepreneurial spirit, and skilled workforce, we can secure a competitive edge in strategic technology sectors and create new sources of prosperity for all Americans.

Revitalizing our techno-industrial base and advanced manufacturing capabilities is essential to this vision. We will also need to invest in research and development, incentivize domestic production, and strengthen critical supply chains. By doing so, we will not only create jobs and bolster our economy, but also give America the resources and independence needed to meet the threat of PRC and other disruptors.

We need to embrace the future with confidence and determination. By adopting a techno-industrial strategy, we can ensure that the United States has the means to remain at the forefront of the 21st century.

Blueprint for Strategic Victory

Pillar 1: Reimagine the Endless Frontier

In the final months of World War II, President Franklin D. Roosevelt recognized the potential for the wartime R&D boom to benefit society. He wrote to Vannevar Bush — then the Director of the U.S. Office of Scientific Research and Development⁴⁵ — asking him to investigate how the U.S. Government could continue to reap the benefits of scientific research once the war ended. Bush responded to Roosevelt's request with a report entitled *Science: the Endless Frontier*, which laid out, among other proposals, a vision of a government-funded, scientist-run agency that would institutionalize government support for scientific research.⁴⁶

The report ultimately catalyzed executive and legislative branch efforts to promote and fund basic scientific research in peacetime, diffuse the benefits of existing developments, and cultivate new scientific talent.⁴⁷ *Endless Frontier* also capitalized on a United States that was emerging from an era where (1) the U.S. Government held a strong role in funding the majority of the nation's leading research and development (R&D),⁴⁸ and (2) actors in the ecosystem had the same broad goal as the federal government — to win the war — an ethos that resulted in the establishment of the Manhattan Project.⁴⁹ Together, those dynamics resulted in an innovation ecosystem aligned with national strategic interests.

⁴⁵ The Office of Scientific Research & Development was established in 1941 with the goal of coordinating, supporting, and enhancing experimental, scientific, and medical research efforts relevant to national defense. See EO 8807, <u>Establishing the Office of Scientific</u> <u>Research and Development in the Executive Office of the President and Defining Its Functions and Duties</u> (1941).

⁴⁶ Vannevar Bush, <u>Science - The Endless Frontier</u>, United States Government Printing Office (1945).

⁴⁷ During the years that passed between the report's publication and the National Science Foundation Act of 1950, a few alternative proposals were floated; of these, Harley Kilgore's version provided the starkest contrast to Bush's. Kilgore's proposal asserted a strong mandate for the agency, non-scientist civilian control, funding for applied research (rather than just basic research), and support for the social sciences. The National Science Foundation Act of 1950 ended up closely resembling Bush's proposal, notably including his scientist-led approach and exclusion of applied research. See Daniel Lee Kleinman, <u>Politics on the Endless Frontier</u>, Duke University Press (1995).

⁴⁸ <u>Federal R&D Budget Dashboard</u>, American Association for the Advancement of Science (last accessed 2024).

⁴⁹ Daniel P. Gross & Bhaven N. Sampat, <u>Inventing the Endless Frontier: The Effects of the World War II Research Effort on Post-War</u> <u>Innovation</u>, Harvard Business School at 5-6 (2020).

Still today, the ripple effects of Bush's *Endless Frontier* can be felt through the many technological innovations that grew from the research the federal government has funded.⁵⁰

To ensure U.S. leadership in critical technology innovation, it is worth revisiting the goals of Bush's original postwar agenda: continuing scientific development, funding quicker and more effective R&D, cultivating the talent pool, and ensuring the diffusion of technology to bring benefits to the American people — while also addressing the broader challenge of bridging the innovation ecosystem with national strategic interests. We must also appreciate the fundamental shifts that have taken place since Bush's era:

- Science and technology have grown in complexity and scale, expanding the scope of innovation. Innovation today is occurring at the intersection of atoms, bits, and cells as multiple general-purpose technologies emerge and converge. The industry-driven digital innovation of the Internet era and the deep, incremental research conducted in academic labs will be insufficient on their own. Technological convergence on such a scale will require systematic cross-disciplinary mechanisms to turn inventions into applications.
- The People's Republic of China has emerged as our chief strategic rival, making the implications of competition more consequential. The PRC is much more integrated into the global economy than the isolated and closed-off Soviet Union (USSR) of the 1950s. The PRC is a formidable competitor in science and technology, drawing on its sprawling industrial manufacturing base, government-directed resources, and unfair international economic practices. Although its centrally planned, top-down government structure resembles the USSR's, the PRC system is more agile and adaptive to the changing pace of innovation. As Beijing doubles down on its attempts to achieve technological self-reliance, it is indeed taking cues from Vannevar Bush on how to position a nation to lead the way to the Endless Frontier.⁵¹
- The center of gravity within the American innovation ecosystem has shifted. Compared to the
 post-WWII era, innovation in the United States today is no longer confined to or being led
 primarily by government labs. Today, American innovation thrives everywhere garages,
 workshops, even makeshift labs and Bush's original "triangle of innovation" of government,
 academia, and industry has since taken on a "new geometry" with the emergence of new

⁵⁰ For example, National Science Foundation-funded research on solid-state physics and ceramics led to the development of modern day fiber-optic communication systems. On the software side, research from the National Center for Supercomputing Applications led to the development of what we know of today as web browsers and Internet interfaces. See <u>Fiber Optics - Nifty 50</u>, National Science Foundation (last accessed 2024); <u>Web Browsers - Nifty 50</u>, National Science Foundation (last accessed 2024).

⁵¹ See Xian-En Zhang, et al., 加强基础研究夯实科技自立自强根基 (<u>Strengthen Basic Research and Consolidate Foundation for Self-</u>

<u>Reliance and Self-Improvement in Science and Technology</u>), Chinese Academy of Sciences (2023) (referencing Vannevar Bush's Science: the Endless Frontier, recognizing the important role of funding basic research as a measure to help achieve strategic self-reliance).

stakeholders and incentive structures.⁵² At the same time, investment in innovation remains concentrated in specific geographical, institutional, and even technological areas, leaving gaps.⁵³ Industry alone cannot bridge these gaps, especially in "deep tech" sectors like biotechnology and clean energy — sectors that often require massive upfront costs, long-term investment, and a willingness to take big risks.⁵⁴

In his letter to Bush, Roosevelt noted, "New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life."⁵⁵ His words were no truer then than they are now — 80 years later — especially in light of Artificial Intelligence (AI).

Four Ways to Create the Necessary Conditions for Innovation Power

In the pursuit of a future where technological innovation continues to drive progress and prosperity, America must embrace a comprehensive strategy that empowers its people, institutions, and industries. This requires a renewed commitment to executing national programs for U.S. leadership, implementing agile funding mechanisms for research and development, building strong public-private partnerships that transcend silos, and equipping the government with the tools to address the challenges of the digital age.⁵⁶ By prioritizing the following four interconnected objectives, America can unleash its full innovation potential, ensuring that groundbreaking discoveries are translated into real-world solutions that benefit all of humanity.

⁵² The ecosystem has pressed beyond Bush's original triangle of innovation, composed of the government, academia, and industry. "The Crowd" has emerged as a powerful actor, driving open-source research in domains like intelligence and AI. Private capital has emerged as an influential funding source of tech development, and industry has over time become the primary funder and executor of applied research and development. The government, meanwhile, continues to fund the majority of basic research, but its ability to steer the trajectory of innovation has atrophied. See <u>Harnessing the New Geometry of Innovation</u>, Special Competitive Studies Project at 22-29 (2022).

⁵³ Aia Sarycheva & Mark Muro, <u>Beyond VC: Financing Technology Entrepreneurship in the Rest of America</u>, Brookings (2021); <u>Competitiveness Through Entrepreneurship: A Strategy for U.S. Innovation</u>, National Advisory Council on Innovation and Entrepreneurship, U.S. Department of Commerce (2024).

⁵⁴ Ben Purser & Pavneet Singh, <u>Unlocking U.S. Technological Competitiveness</u>, Institute for Security and Technology (2024). Oihana Basilio Ruiz de Apodaca, et al., <u>What is "Deep Tech" and What are Deep Tech Ventures?</u>, MIT Management Global Programs (2023).
⁵⁵ Vannevar Bush, <u>Science - The Endless Frontier</u>, United States Government Printing Office (1945).

⁵⁶ The priorities align with <u>Driving U.S. Innovation in Artificial Intelligence: A Roadmap for Artificial Intelligence Policy in the United</u> <u>States Senate</u>, The Bipartisan Senate AI Working Group (2024).

Recommendation 1

Pillar 1

Organize American Leadership for National Programs

Preserve America's global leadership in cutting-edge research and development by identifying and funding national programs that develop positional advantage in key technology battlegrounds.

Technology strategy will carry little geopolitical weight unless it is translated into actual fielded technology capabilities. National programs can turn our competitive advantages into positions of advantage in the technologies that matter.⁵⁷ The United States has a history of setting and meeting audacious national technology ambitions when the moment demands it. The Manhattan Project, Apollo Program, and Operation Warp Speed exemplify America's ability to harness the collective strength of our innovation ecosystem toward national ends. A "moonshot mindset" for each technology battleground is critical for U.S. leadership in the age of innovation power.

The goal for a national program or a "moonshot" should be high, pushing past incremental technical progress and instead shifting the boundaries of what is scientifically possible and creating new paradigms. For a moonshot to effectively translate competitive advantages into technical leadership and, ultimately, innovation power, it requires a **whole-of-ecosystem** effort. This effort should be overseen by dedicated leaders — a National Mission Manager — who is accountable for the program's success. While the correct number and type of national programs are determined through technology and competitive strategy arguments, all moonshots require resources, accountability, and resolve to see their ambitions through.⁵⁸

Recommendation 2

Fund a Dynamic and Resilient Innovation Ecosystem

Develop flexible and responsive funding mechanisms that support innovation at all stages, from basic research to commercialization, while fostering international collaboration and promoting a competitive environment for startups.

To maintain its edge, the United States needs renewed and expanded investments at every stage of technological development, from basic research all the way to commercialization. The current funding landscape where the government primarily supports fundamental research to prove technological

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⁵⁷ <u>Harnessing the New Geometry of Innovation</u>, Special Competitive Studies Project at 30 (2022).

⁵⁸ <u>Harnessing the New Geometry of Innovation</u>, Special Competitive Studies Project at 55-56 (2022).

concepts and private capital offers seed and series funding is not optimized to support the next generation of technologies that increasingly require sustained and substantial amounts of resources to reach commercial scale.⁵⁹ Additionally, the timeline and rigidity of the federal budget process does not always match the rate of technological change and the objectives of private investors do not always align with the nation's strategic needs.⁶⁰ To translate scientific breakthroughs into real innovation power, the United States must develop versatile investment mechanisms to propel strategic technology development, transcend traditional funding cycles, and bridge public and private investment timelines.⁶¹

The United States must first set the foundation for innovation by increasing its federal investments in research and development (R&D) to one percent of GDP by 2030.⁶² Increased federal investment for R&D should emphasize non-defense AI and support critical AI research infrastructure like the National AI Research Resource (NAIRR) as artificial intelligence rapidly accelerates scientific discovery and tech development.⁶³ Federal investment mechanisms should also be expanded to support first-of-a-kind technologies, moving scientific ideas closer to functioning prototypes by utilizing the government's ability to become a technology's "first buyer" or "guaranteed customer" which derisks private investments and creates market demand.⁶⁴ Lastly, the United States should build upon federal resourcing and align the entire capital stack with national needs through a public-private fund to increase flexibility and balance when channeling investments toward technology development. Through different and expanding

⁶² Federal R&D expenditure equaling 1% of GDP in 2030 is benchmark for future funding levels and would be roughly equivalent to the proportion the federal government spent on R&D during the 1960s and 1970s to accomplish the Apollo Mission. In 2022, federal R&D spending as a percentage of GDP was 0.73%. See <u>Historical Trends in Federal R&D</u>, American Association for the Advancement of Science (last accessed 2024); <u>Funding for the Future: The Case for Federal R&D Spending</u>, Special Competitive Studies Project (2024).

⁵⁹ Jean-François Bobier, et al., <u>An Investor's Guide to Deep Tech</u>, Boston Consulting Group (2023).

⁶⁰ In the last 46 years, the U.S. Government's budget has often been appropriated by Continuing Resolutions (CR), which keep funding flat, freeze new programs and projects, and ultimately, slow critical R&D down. See Alessandra Zimmermann, <u>Impacts of a Continuing Resolution</u>, American Association for the Advancement of Science (2024); <u>Final Report: Defense Resourcing for the Future</u>, Commission on Planning, Programming, Budgeting and Execution Reform, U.S. Department of Defense (2024); <u>Harnessing the New Geometry of Innovation</u>, Special Competitive Studies Project at 26 (2022); Darrell M. West, <u>R&D For the Public Good: Ways to Strengthen Societal Innovation in the United States</u>, Brookings (2022).

⁶¹ <u>National Action Plan for U.S. Leadership in Next Generation Energy</u>, Special Competitive Studies Project at 10 (2024); Ben Purser & Pavneet Singh, <u>Unlocking U.S. Technological Competitiveness</u>, Institute for Security and Technology (2024); Oihana Basilio Ruiz de Apodaca, et al., <u>What Is "Deep Tech" And What Are Deep Tech Ventures?</u>, MIT Management Global Programs (2023).

⁶³ Federal funding for non-defense AI R&D should double annually to reach \$32 billion in 2026 to take full advantage of AI's convergence with other science and technological sectors, as well as encourage the development of the AI field itself. Federal investment should support AI and AI-enabled research, and critical R&D infrastructure, such as the National AI Research Resource (NAIRR). See <u>Funding for the Future: The Case for Federal R&D Spending</u>, Special Competitive Studies Project (2024); <u>Driving U.S.</u> <u>Innovation in Artificial Intelligence: A Roadmap for Artificial Intelligence Policy in the United States Senate</u>, The Bipartisan Senate Working Group (2024).

⁶⁴ See <u>Harnessing the New Geometry of Innovation</u> Special Competitive Studies Project at 40-41 (2022); Andrew J. Fieldhouse & Karel Mertens, <u>The Returns to Government R&D</u>: <u>Evidence from U.S. Appropriations Shocks</u>, Federal Reserve Bank of Dallas (2023); John Paschkewtiz & Dan Patt, <u>No. We Don't Need Another ARPA</u>, Issues in Science and Technology (2023); Karine Khatcherian, <u>Barriers to</u> <u>the Timely Deployment of Climate Infrastructure</u>, Prime Coalition (2022). Arielle D'Souza, <u>How To Reuse the Operation Warp Speed</u> <u>Model</u>, Institute for Progress (2023).

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funding mechanisms, the United States can keep pace with the rapid technological change occurring today and secure the ability to create the innovations of tomorrow.

Recommendation 3

Build Strategic Public-Private Partnerships for National Technology Strategy

Establish a collaborative ecosystem where government, industry, academia, and regional innovation hubs work seamlessly to translate research into real-world solutions, address national challenges, and strengthen America's technological competitiveness.

The failures of the pre-WWII era and the demands of the postwar era in Vannevar Bush's time necessitated the creation of a National Security Council. The techno-economic competition underway today demands a bold institutional response. This includes a set of new organizations that work across the innovation ecosystem to conduct horizon scanning and critical technology assessments, set national technology ambitions, and coordinate their implementation. At the national level, as SCSP has previously recommended, these essential functions could be fulfilled by a Technology Competitiveness Council (TCC), an Office for Global Competition Analysis (OCA), and a United States Advanced Technology Forum (USATF).⁶⁵ Together, these entities would provide the institutional scaffolding to harness the diversity and complexity of the 21st-century innovation ecosystem to achieve national ends.

At the subnational level, every region, state, and city can tap into its own unique form of innovation power, amplifying the impact of the federal government's investments in tech hubs.⁶⁶ Across the nation, regional innovation is driven by clusters of community colleges, universities, national laboratories, regional incubators and accelerators, local capital firms, philanthropies, and engaged citizenry, with the support of multiple levels of government.⁶⁷ Harnessing this innovation capacity across the nation will require creating connections across the institutions or nodes, resulting in a "nucleated" ecosystem that supports growth and tech development.⁶⁸ Bolstering support for NSF's Directorate for Technology, Innovation, and Partnerships and EDA would continue to catalyze the creation of these connections

⁶⁵ A White House-based TCC would serve as a central hub to coordinate national tech strategy. An OCA — based either in the White House or an FFRDC — would provide a consistent analytic center across administrations. Finally, a parallel federally chartered nonprofit, USATF, would offer an external convening function and additional analytic capabilities. See <u>Harnessing the New Geometry of</u> <u>Innovation</u>, Special Competitive Studies Project at 49-58 and 93-102 (2022).

⁶⁶ Maryann Feldman, <u>Place-Based Economic Development</u>, Issues in Science and Technology (2022).

⁶⁷ <u>Policy Summary</u>, Jump-Starting America (last accessed 2024).

⁶⁸ Grace J. Wang, <u>Revisiting the Connection Between Innovation, Education, and Regional Economic Growth Between</u>, Issues in

Science and Technology (2024); Harnessing the New Geometry of Innovation, Special Competitive Studies Project at 22-29 (2022).
across the nation.⁶⁹ At a regional level, such bridges can take the form of novel public-private partnerships and organizations that foster interactions between academia, government, industry, and private capital.⁷⁰ Exemplar bridging organizations like Engine Ventures in Boston and Capital Factory in Austin are already demonstrating how local tech-focused venture funds can help catalyze regional innovation.⁷¹

Recommendation 4

Pillar 1

Modernizing Governance for the Innovation Age

Organize and equip government agencies with the expertise, agility, and forward-thinking policies necessary to guide the innovation landscape, effectively harness the benefits of emerging technologies, and mitigate potential risks.

Under the breakneck pace of current innovation development, governing agencies have struggled to manage the negative externalities and risks of new technologies. At the same time, an exclusive focus on de-risking may limit necessary government concentration on harnessing a new technology's unrealized benefits. Proactive technology governance must balance both mitigating harms and harnessing innovative benefits by establishing a mutable and iterative risk-based approach, focusing governance specifically on highly consequential use cases, both good and bad.

We cannot and should not regulate every AI development and use. Rather, regulatory efforts should focus on AI highly consequential to society. Building on SCSP's Framework for Identifying Highly

⁶⁹ The federal government should continue to provide resources for NSF's Directorate for Technology, Innovation, and Partnerships to allow for future Regional Innovation Engines awards and modernize the Economic Development Administration's mission and expand its authorities to further support local innovation and economic development. Despite receiving sizable funding for many new placebased innovation programs in legislation like the CHIPS and Science Act, EDA's mission has not been reauthorized or updated since 2004 and should be refreshed to align with the EDA's new regionally focused programs and today's techno-economic challenges. See Amy Liu, et al., <u>Making Local Economies Prosperous and Resilient: The Case for a Modern Economic Development Administration</u>, Brookings (2022); Mark Muro, <u>With its Winners Announced</u>. The Regional Innovation Engines Program Moves to Expand Place-Based <u>R&D</u>, Brookings (2024); Ryan Buscaglia & Melissa Roberts Chapman, <u>Cluster Development is the New Economic Development</u>, Federation of American Scientists (2023).

⁷⁰ Harnessing the New Geometry of Innovation, Special Competitive Studies Project at 28 (2022).

⁷¹ The defining feature of a regional innovation ecosystem that works well is the connections between institutions, resources, and capabilities that combine to shape and build upon the regional comparative advantage of that region. It is necessary to right-size these bridging mechanisms to a region's current resources and strengths, as, for example, what works in Boston might not work in Birmingham, Alabama. See Jorge Guzman, et al., <u>Accelerating Innovation Ecosystems: The Promise and Challenges of Regional</u> Innovation Engines, National Bureau of Economic Research (2023); Jan Jard, et al., Melissa Roberts Chapman & Alice Wu, <u>What Works</u> in Boston, <u>Won't Necessarily Work in Birmingham: 4 Principles for Building Commercial Capacity in Innovation Ecosystems</u>, Federation of American Scientists (2023); David Rotman, <u>The \$100 Billion Bet that a Postindustrial U.S. City Can Reinvent Itself as a High-Tech</u> <u>Hub</u>, MIT Technology Review (2023); <u>Our Mission</u>, The Engine Accelerator (last accessed 2024); <u>Ventures</u>, Capital Factory (last accessed 2024).

Consequential AI Use Cases (HCAI), governing agencies can devise systems of identifying technologies that have or will have significant impacts on society, whether beneficial or harmful, and adjust regulations accordingly to avoid overregulation.⁷² As each agency and its respective technology sector has to consider different degrees of risk tolerance, technical requirements, and innovation ecosystems in governance, building a sector-specific governance structure that is iterative and adaptable is critical for balancing innovation with regulation. These systems should build off existing risk-management strategies toward agency use of AI.⁷³

Data is foundational to effective implementation of governance strategies and policies. Regulatory agencies will require access to relevant and usable information to make necessary assessments and take actions. Fundamentally, the United States must adopt a comprehensive National Data Policy. The free and secure flow of data can allow greater trust and communication between private-public partnerships and a deeper understanding of the "black box" of innovation and its risks.⁷⁴ However, good governance must also maintain awareness of the risks of open source research and devise new methodologies and approaches to identify and protect sensitive R&D information.⁷⁵ To facilitate trust and deeper cooperation among our democratic allies, the United States must integrate these research and data security protections into new global efforts to establish innovation supply chains as technology becomes more costly and globalized.

Additionally, the United States must continue its work on establishing standards and norms to implement AI governance. For example, the National Institute of Standards and Technology (NIST) can develop risk and bias identification systems that help frame the regulation of new technologies, building off the structure of the NIST AI Risk Management Framework.⁷⁶ Risk identification should also integrate non-traditional understandings of risk and national security as environmental, social, equity, developmental risks are all critical to technology governance. Some risks are inherent. To build trust in new technologies, all innovation must be provided a standard of privacy and cybersecurity to avoid structural risk; privacy-enhancing technologies, red-teaming, and other government-supported tools can be made available to all innovators to maintain such standards.

Technologies Determining the Future of National and Innovation Power

In an era of unprecedented technological advancement, the United States, together with its allies, stands at a pivotal juncture. We have the opportunity — indeed, the responsibility — to shape the future of innovation in a way that reflects our shared aspirations and values, and upholds the principles that have

⁷² <u>Framework for Identifying Highly Consequential AI Use Cases</u>, Special Competitive Studies Project (2023).

⁷³ <u>Advancing Governance, Innovation, and Risk Management for Agency Use of Artificial Intelligence</u>, U.S. Office of Management and Budget (2024).

⁷⁴ <u>National Data Action Plan</u>, Special Competitive Studies Project (2022).

⁷⁵ <u>Safeguarding the Research Enterprise</u>, JASON (2024).

⁷⁶ <u>AI Risk Management Framework</u>, U.S. National Institute of Standards and Technology (2023).

long defined our democracies. By forging a united vision and investing strategically in fields like nextgeneration AI, including AGI, biotechnology, advanced networks, advanced computing, next-generation energy, advanced manufacturing, we will not only fuel economic growth and prosperity but also ensure that these transformative technologies are harnessed for the greater good. This is our chance to lead the world toward a future where innovation uplifts humanity, protects our planet, and strengthens the bonds of freedom and collaboration that bind us together.

Recommendation 5

Next-Generation AI and the Path to AGI: Charting the Course for American Leadership Ensure leadership on future generations of AI models to set the right path for AGI.

It is imperative for the United States to maintain its leadership in artificial intelligence (AI) and proactively accelerate and address the development of Artificial General Intelligence.⁷⁷ To that end, the United States should stand up a task force⁷⁸ composed of technologists and leaders from the legislative branch, the executive branch, industry, civil society, and academia to develop a comprehensive national strategy encompassing four critical objectives:

- Analyze the Pre-Arrival Phase: Thoroughly assess the current landscape, including our nation's technological standing, potential adversaries' capabilities, present bottlenecks, and the key requirements for achieving AGI. This involves examining hardware, data, software, and potential pathways from narrow AI to AGI.
- 2. **Prepare the Country for AGI's Impact:** Develop a plan to address the transformative effects of AGI on the American workforce, education system, society, and geopolitical landscape as a whole. This includes anticipating potential disruptions and implementing measures to ensure a smooth transition.

⁷⁷ In the U.S. Senate, one major initiative that seeks to chart a path toward U.S. leadership in AI, is outlined in the report: <u>Driving U.S.</u> <u>Innovation in Artificial Intelligence: A Roadmap for Artificial Intelligence Policy in the United States Senate</u>, The Bipartisan Senate AI Working Group (2024).

⁷⁸ In The Age of AI and Our Human Future, co-authors Henry Kissinger, Eric Schmidt, and Daniel Huttenlocher underscored how many countries, including our adversaries, have made AI an institutionalized national priority, whereas the United States "has not yet as a nation, systematically explored its scope, studied its implications or begun the process of reconciling with it." While the United States has made strides on this front, still more can be done. In the book, Kissinger and Schmidt went on to recommend standing up a commission with two functions, to study how the United States can remain intellectually and strategically competitive in AI and more globally, to study and raise the awareness of AI and its cultural implications. These goals should be part of the remit of the proposed task force. See Henry Kissinger, et al., <u>The Age of AI and Our Human Future</u>, Little, Brown and Company at 224-225 (2021).

- 3. Establish Robust Policies: Propose comprehensive policies to govern the development and deployment of AGI systems, ensuring alignment with American laws, democratic values, international norms, and ethical principles. This framework will safeguard against misuse and ensure that AGI benefits humanity while mitigating potential risks.
- 4. Coordinate with Like-Minded International Partners: Establish a collaborative mechanism (e.g., consultative working group) to ensure the development of AGI systems in the United States fosters joint R&D, collaborative standards and governance setting, and sharing of best practices with close allies and partners.

By embracing these four objectives, the United States can proactively shape the path toward AGI, harnessing its transformative potential while upholding the values that define our nation.

Yet AGI alone will be insufficient to lead the era of innovation power. Al will converge with other technologies that will drive the destiny of nations. Global technology leadership will accrue to the nation(s) that master the full set of convergent general purpose technologies. The process and outcome of developing national AGI capabilities could directly feed into and be accelerated by establishing national programs or moonshots in other critical technology sectors, such as:

Recommendation 6

Pre-Empting Future Threats: Containing Disease with Biotechnology

Drive advancements across the biotechnology stack for defense against pathogens and position the United States at the forefront of the bioeconomy revolution.

We are on the precipice of an era where individuals and nation-states alike will have the data and the tools to manipulate the essence of life as we know it. Biotechnology will generate massive opportunities in industries that span medicine, manufacturing, materials, agriculture, energy, and much more. The United States and our allies and partners have an opportunity to outcompete our rivals to gather the data, build the platforms, and create the infrastructure for the bioeconomy. Yet biology knows no borders. Its impacts will be inherently diffuse and interconnected. This creates distinct benefits and risks in the context of a global competition. A strong security baseline will enable us to step confidently into a world where we can build with biology.

The establishment of a standing **Medshield** could build upon current biotechnology initiatives and combine with other moonshots and strategic moves to secure the U.S. biofuture. A national medical shield would operationalize pathogen defense and act as a global biothreat "radar," negating the need for a reactive effort with every new medical crisis. This national medical shield would harness and spur public-private innovations across the biotechnology sector and tech categories such as rapid vaccines,

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therapeutics, biothreat detection, Al-driven modeling, accelerated manufacturing, and enhanced trials.⁷⁹

Recommendation 7

Growing National Connectivity: Deploy Advanced Networks

Develop and deploy secure, cutting-edge networks that facilitate pervasive and resilient connectivity, to support current and future interconnected, digital technologies.

Advanced networks form the foundation of the modern world, underpinning global communications and embedded into computing, sensing, and AI capabilities. Nations that lead the development and production of advanced network hardware and software will control elements of the digital economy from cybersecurity to new network-enabled applications like autonomy and robotics. Therefore, the nation must invest in critical research and real-world pilots, enact policies that lower barriers to innovators, and foster distributed disruptive network innovation.

A national program to develop free space optical networks (FSONs) at scale would be one step toward U.S. advantage within this sector. FSONs – commonly referred to as "fiber without the fiber" – would enable point-to-point communications through air, space, and water via lasers while reducing the dependency on terrestrial-based infrastructure and serve a multitude of applications across the defense, industrial, logistics, agricultural, and consumer sectors.⁸⁰ With the potential to become a new primary or secondary connectivity option, a moonshot for FSONs, combined with a secure, resilient supply chain, would accelerate the nation's path to 5G and beyond.⁸¹

Recommendation 8

Leading a Post-Moore's Law World: Spearhead Novel Compute Paradigms

Usher in the post-Moore's Law era of compute by positioning the United States to scale and integrate emerging computing paradigms, such as quantum, neuromorphic, and reversible computing.

⁷⁹ To learn more about SCSP's recommendation to establish Medshield and other biotechnology moonshots, see <u>National Action Plan</u> <u>for U.S. Leadership in Biotechnology</u>, Special Competitive Studies Project (2023).

⁸⁰ Ben Skuse, Free Space Optics to Connect the World, The International Society for Optics and Photonics (2023).

⁸¹ To learn more about SCSP's recommendation to establish a national program on free-space optical networks and other advanced networks moonshots, see <u>National Action Plan for U.S. Leadership in Advanced Networks</u>, Special Competitive Studies Project (2023).

Computational power, or compute, underpins AI capabilities as well as scientific and technological progress across all fields. Today, however, an asymmetry exists between the rapid rate of progress in AI and the much slower gains in compute performance and cost that the semiconductor industry can provide. This asymmetry is the culprit behind the ongoing massive global data center buildout and rapid growth in energy usage and subsequent rising costs for AI training and inference. Yet novel compute paradigms exist that could catalyze a 1,000 times or greater improvement in performance and energy usage. Beyond that, the United States must catalyze disruptive innovation and build an atoms-to-architecture pipeline that develops, scales, and integrates novel materials and devices to unlock novel microelectronics and computing paradigms.

A national program that aims to integrate multiple forms of compute would help the United States lead a post-Moore's Law world. A hybrid computing approach, backed by the appropriate software stacks and APIs, could apply the right compute "tool" to hard problems. Creating a moonshot and charging a National Mission Manager to develop hybrid computing architectures would not only tackle immense societal challenges by integrating AI across diverse computing paradigms from conventional CMOS to novel hardware-based approaches but also would allow the United States to have a dominant advantage in microelectronics past this decade.⁸²

Recommendation 9

Accelerating Next-Generation Energy: Power Technology with Fusion Energy Grid

Build a diverse portfolio of energy technologies to fuel the next wave of AI and emerging technologies to spur the transition to clean energy sources.

The ability to produce and use energy when and where it is needed is central to securing technological and geopolitical advantages. Energy cuts across all domains and is not only an input for future technologies but is also transformed by them. As the global energy system evolves due to increased demand and a shift in how we generate, store, and move energy, U.S. leadership in the sector will require a diversified approach — not a silver bullet.

Pushing **fusion energy** from the lab to the grid within the next decade is one pathway to securing U.S. positional advantage in next-generation energy technologies. Fusion offers a source of clean, limitless energy, bringing the power of the sun to Earth. A national program to deliver multiple, energy-producing fusion pilot plants to the grid should encourage multiple technical pathways and expand upon existing

⁸² To learn more about SCSP's recommendation to establish a national program on hybrid computing architectures and other advanced compute and microelectronics moonshots, see <u>National Action Plan for U.S. Leadership in Advanced Compute &</u> <u>Microelectronics</u>, Special Competitive Studies Project (2023).

programs to encourage fusion development. Reaching the goal of functioning fusion pilot plants would not only push the boundaries of scientific achievement but establish the foundations of a policy apparatus for a future thriving fusion ecosystem.⁸³

Recommendation 10

Driving Technological Convergence: Accelerate Adoption of Advanced Manufacturing Systems

Drive the adoption of advanced manufacturing technologies at scale, leveraging U.S. innovation advantages in AI and software to partially offset the PRC's scale-based manufacturing model.

An array of emerging technologies — from AI and robotics to augmented reality and physics-based modeling — are converging to create a new paradigm for designing and making things. This paradigm, often called advanced manufacturing, is premised on convergence between the physical and digital worlds. Today's cutting-edge factories are fully integrated cyber-physical systems, powered by an AI-enabled "digital thread" running from product design through deployment. These systems create actionable data that can be fed back into industrial AI models, creating tighter feedback loops that deliver significant innovation advantages. In practice, advanced manufacturing means producing goods in a way that is faster, more flexible, and sustainable.

To ensure positional leadership in advanced manufacturing, the United States should establish the construction of 500 **Factories on the Frontier** as a national goal. These leading-edge facilities would deploy advanced manufacturing technologies in innovative ways and exemplify a software-defined approach to production. A small number of these facilities exist today, but firms of all sizes face challenges, from high capital costs to shortages of workers and system integrators. A national program would track the construction of facilities and offer federal support, in the form of tax incentives and access to system integration capabilities.⁸⁴

⁸³ To learn more about SCSP's recommendation to establish a moonshot on fusion energy and other energy-related initiatives, see <u>National Action Plan for U.S. Leadership in Next-Generation Energy</u>, Special Competitive Studies Project (2024).

⁸⁴ More details can be found in SCSP's forthcoming National Action Plan for U.S. Leadership in Advanced Manufacturing, which will be published in the Summer of 2024.

Pillar 2: Restore Peace and Security through AI and Emerging Technologies

Foreign Policy in the Age of Technology Competition: Charting the Course for U.S. Global Leadership

Our adversaries recognize the appeal of the United States and other free societies to those behind a "Great Firewall." They understand that the individual freedom for which we stand — and to which humanity aspires — strikes at the very core of their authoritarianism. These adversaries refuse to address the failures of their systems of government; instead, they seek to exaggerate and disparage the flaws of our own in order to diminish freedom's appeal. They stifle the spread of democratic values among their people, silencing calls for freedom, transparency, and selfgovernment. They have made some headway by building a narrative against American leadership, values, and interests, and by using technology to disseminate lies at a speed the truth cannot match.

To be sure, there will always be those who will criticize the United States for any apparent gap between its principles and its foreign policy practices. Yet what sets the United States and other free societies apart is the fact that we are willing to openly acknowledge and rectify our shortcomings. Autocracies, by contrast, insist upon their infallibility, and scarcely tolerate any calls for self-improvement.

The principles that define our nation have not changed. Yet the technological landscape demands an evolution in their application. Just as our competitors and adversaries seek to mold the world in their image, so too must the United States and its allies and partners work to shape a global order that mirrors our ideals and serves our interests.

Technology is power, and technology strategy is now a quintessential part of grand strategy. How well nations organize themselves to compete for technology leadership will permeate across foreign policy, economic, and military dimensions, and determine the character of the global order. We already see what our adversaries intend: they lack an affirmative vision for either themselves or the world, and instead seek to leverage technology to control their people and undermine our values, interests, and the world order. Our purpose must be to offer a new vision for how free societies can leverage their technological advantages, promote values to support human dignity and societal progress, strengthen the commitment to individual liberties, and safeguard our societies.

We recommend six elements to serve as the driving force of our foreign policy.



Technology platforms, from telecommunications to microelectronics, have clear and profound implications on national and global security. "Tech" can no longer be seen as a consumer product and a domestic regulatory policy, but must be treated as a strategic battleground upon which the United States and its allies and partners must seek an advantage. Democracies must harness their technological prowess not only to safeguard their own societies but to champion the cause of freedom worldwide. Their innovation power, much like their alliances, are exceptionally difficult for autocracies to replicate. To do this, we will need new strategies and organizations for how the United States and its allies and partners can work together to innovate, compete for, and build out the technology platforms that will shape the future.

Recommendation 2

Creating the Next Generation of International Institutions

Modernize existing and design new international institutions and regimes to reflect the changing geopolitical and technological landscapes.

The United States and its allies and partners built and shaped the prevailing global architecture and international institutions to promote peace and stability over the previous eight decades. The unfolding complexities of the global stage demand a re-evaluation, reconstruction, and reimagination of these institutions. The United States and its allies and partners must once again lead this effort. These new institutions must be robust enough to enforce the norms and standards of today, and chart those of tomorrow, including for governing the emerging technology landscape. This next generation of institutions can establish an environment conducive to peaceful cooperation and technological exchanges for the development and deployment of open, safe, trustworthy, and secure technologies around the world.

Pillar 2

Recommendation 3

Focusing on the Next Generation of Strategic Battlegrounds

Identify and prioritize key technological and geographic terrains that are essential to the geopolitical competition.

Europe was the focal point of competition and conflict in the 20th century. While we must not lose sight of winning in Ukraine or the risk of escalating conflict in the Middle East and Northeast Asia, the Indo-Pacific region will most certainly be the focal point of geopolitical competition for the rest of the 21st century. At the same time, demographic disparities between different regions of the world may also signal shifts of economic influence. On the technology front, the concentration of the chip industry in Taiwan and extreme ultraviolet lithography machines in the Netherlands have highlighted geographical opportunities and risks in tech supply chains. Fields such as artificial intelligence, quantum computing, and biotechnology are becoming crucial, as leadership in these areas significantly affects national security and global standing. Understanding how geography, geopolitics, and technology will interact in the future will be vital to ensuring the United States and its allies and partners can focus on key strategic regions and technologies.

Recommendation 4

Reinvigorating Strategic Communications to Amplify our Vision

Build the institutional and technological capacity to effectively communicate the strength of our societies, values, and policies and counter the lies intended to undermine them.

The storytelling power of the United States was a critical tool of statecraft as our nation became a global superpower. Through words and images, we conveyed the promise of our society, values, and policies throughout the world. In an era where information is both a weapon and currency, strategic communications become even more important. The United States must refine its ability to effectively communicate its values and counteract the narratives propagated by the Axis of Disruptors. Reinvigorating our strategic communications tradecraft will require a comprehensive strategy that includes diplomatic channels, media engagement, and digital platforms to ensure that our message resonates globally and that we push back against the lies that our adversaries spread. By clearly articulating our stance and debunking the misinformation spread by adversarial forces, we reinforce our posture and reaffirm our commitment to the principles of freedom and prosperity.

Pillar 2

Recommendation 5

Designing a Foreign Policy Instrument of Power for Global Technology Competition

Adopt bold reforms to hone the tools of statecraft, develop new capabilities, and build a new alignment with the private sector to transform the mission and purpose of U.S. foreign policy for this new era of competition.

As technology permeates every aspect of national power and the international strategic context, the United States must recalibrate its foreign policy instruments. To begin with, this recalibration means integrating technological strategy at the core of our diplomatic engagements, economic policies, and defense postures. This will also mean modernizing U.S. foreign policy posture and resources around the requirements of technology competition. Importantly, this will require a Department of State with a tech-forward diplomatic corps and cutting-edge tools to lead and execute this foreign policy. We also need a more proactive presence among our allies and partners as well as adversaries to advance our interests and those of our allies. Finally, our governments cannot succeed in this era of global technology competition on their own. We will need new channels of engagement and collaboration to bring private sector partners to better understand and manage the opportunities and risks that lay at the frontiers of technology.

Recommendation 6

Testing Calculated Engagement with Disruptors

Balance a strategy of diplomacy and coercion to curb the destabilizing actions of the Axis of Disruptors.

In dealing with the Axis of Disruptors, a nuanced strategy is required. We should not "self-deter" from taking action to prevent or roll back destabilizing activities the Disruptors may engage in to undermine our interests. These actors, either as a group or individually, must be confronted with tact and precision; a mix of diplomacy and coercion is needed to mitigate their adverse impacts. Our goals in these engagements should be clear: to discourage behaviors that threaten global stability and to encourage a return to compliance with international norms. This approach will maintain pressure on these actors while testing the proposition of whether they are willing to eventually integrate into a rule-based world order.

"The only question is whether peace shall be the whole aim of foreign policy; whether everything shall be yielded to that end. Clearly the answer must be no. The risks that arise from the possibility of war are great. But by resolutely accepting the risk — and by that alone — we gain a decent chance to avoid it." Prospect for America: The Rockefeller Panel Reports (1961)

Agile Warfare: Mastering Speed and Scale for Strategic Advantage

While diplomacy remains an indispensable tool, the advancement of liberty and democracy necessitates a credible foundation of hard power. The future strategic advantage of the U.S. military lies in the fusion of enduring operational principles with the next-generation of advanced technologies. This framework must make use of the transformative potential of AI and emerging technologies to offset potential adversaries, dissuade acts of aggression, and prevail decisively in armed conflict. Resilience, scalability, accelerated decision-making, adaptability, risk taking and mitigation, and optimized lifecycle costs constitute the essential and enduring elements of a future operational concept. The United States must integrate these attributes into the very heart of the Joint Force, thereby driving its transformation and securing the requisite capabilities.

Recommendation 7



Dominating the Spectrum: Agile and Integrated Warfare

Field a resilient, Al-powered, multi-domain command and control system that integrates cyber, information, space, electromagnetic, and traditional battlegrounds, and aims to improve interoperability with our allies to outmaneuver adversaries in every domain.

Modern warfare has evolved beyond traditional domains, marked by cyberattacks that cripple critical infrastructure, disinformation campaigns that disrupt societies, and space-based assets crucial to military operations. To address this, military forces must abandon old paradigms and adopt a holistic approach to operations across all domains.

Adversaries exploit gaps between land, sea, air, space, and cyberspace with hybrid tactics that blend conventional warfare with cyberattacks and information warfare. In response, a unified and agile strategy is essential to outpace these multifaceted threats. Integrated warfare is key, enabling rapid adaptation and seamless interoperability across domains and with allies, thereby maximizing collective capabilities and minimizing vulnerabilities.

Looking ahead, the Department of Defense (DoD) should anticipate a global, multi-domain threat landscape that includes homeland threats. The Joint Warfighting Concept should guide preparations, emphasizing resilient, Al-enhanced command and control systems to meet these

challenges. The DoD should re-evaluate the Unified Command Plan to better align with global, multi-domain scenarios and should consider empowering Cyber Command (CYBERCOM) with expanded authorities to streamline cyber, information, and electromagnetic operations.

Additionally, proposals such as the creation of a Digital Service Academy and an Information Warfare Service aim to equip CYBERCOM with skilled personnel ready to handle the complexities of digital warfare, fostering a more robust public-private partnership in defense capabilities. These strategic adaptations are critical for maintaining a competitive edge in an era of sophisticated and evolving threats.

Recommendation 8

Pillar 2

Mastering the Machine: Technological Supremacy in the Age of Al

Achieve commanding leadership in AI and emerging technologies. Accelerate innovation and secure the digital battleground to ensure our technological arsenal outpaces all contenders.

The DoD will be unable to build a relevant Joint Force if the United States fails to maintain technological leadership. In the 1950s, U.S. leadership in nuclear technology offset Soviet conventional advantages in Europe. Leadership in stealth, precision munitions, microprocessors, and telecommunications did so again in the 1970s and 1980s. During these periods, the U.S. Government was the prime mover in emerging technologies, with government imperatives and investments guiding the innovation base toward new frontiers. Today, the private sector leads the direction and pace of innovation,⁸⁵ out-investing the government in key areas of AI, quantum computing, autonomous systems, biotech, space, and other emerging technologies. As these technologies promise to create new capabilities, DoD will need the organizational structure to experiment with and integrate them at a rate faster than adversaries. To this end, the Department should stand up a "Joint Futures Command" whose mission is to scan the horizon and comprehend how new technologies will change the speed and character of warfare. This organization should provide prescriptions for the design of U.S. forces that are anticipatory and responsive to these changes, develop future concepts for employment, and – critically – be resourced to acquire select emerging capabilities that are of joint use.

⁸⁵ Audrey Kurth Cronin, <u>How Private Tech Companies Are Reshaping Great Power Competition</u>, Henry A. Kissinger Center for Global Affairs, Johns Hopkins University (2023).

Recommendation 9

Innovation as Armor: Fortifying Deterrence

Revise and adapt deterrence strategies to address the changing character of threats, including hybrid warfare, cyber attacks, information domain, and space-based conflicts.

Threats are transforming in velocity, complexity, and reach. Borders are increasingly penetrable through new domains and asymmetric means. Future conflicts are unlikely to be theater- or domain-specific. The Joint Force of the mid-decade must be tech-adroit to deter our adversaries on this landscape. Prioritizing investment in critical technologies and capabilities is a deterrence strategy unto itself; assuming prime mover status at the leading edge of warfare invalidates adversary investments and concepts. If harnessed appropriately by the DoD, AI and emerging technologies can underpin the Joint Force's ability to deter opportunistic aggression and prevail across the spectrum of conflict. Advanced technologies can and should be complementary to the legacy Joint Force and integrate allied and partner capabilities and revise deterrence models and concepts accordingly. The DoD should also identify a set of attributes to guide the development of new operational concepts. Such attributes could include accelerated decisionmaking, scalability, and adaptability. The United States needs to act now — with deliberateness and determination — to define these attributes, evolve the Joint Force to reflect them, and pursue the capabilities that they demand.

Recommendation 10



The Crucible of Talent: Cultivating the Warriors and Innovators of Tomorrow

Invest in the heart of our defense: our people. Foster a culture of innovation, critical thinking, warfighting ethos, and unparalleled skill to ensure the next generation of defenders are prepared to face the challenges of a new era of conflict.

Future warfighters and government civilians will need to out-innovate, out-think, and outnavigate U.S. adversaries in a complex environment. Success rests on a workforce that is organized, trained, and equipped to win. This requires new thinking on human capital, emerging technologies, future warfighting concepts, and multi-domain challenges within the Defense enterprise. As part of this rethinking, the Department should establish digital career pathways within the Services that develop personnel with specialized technical expertise. Adequately upskilling all uniformed and civilian personnel for data- and AI-enabled operations should also be a top priority: currently, this is neither consistently provided nor sufficiently tailored to defense applications. The Department should further use existing authorities to bring able and experienced professionals with expertise in critical and emerging technologies in at higher pay scales and pay grades via non-traditional pathways. Greater use of flexible service options, including a viable reserve component (such as the Army's 75th Innovation Command, the Marine Innovation Unit, or the Air Force's Education with Industry program), would attract exceptionally skilled private sector personnel to maintain positions in the technology sector while also serving their country in a part-time capacity.⁸⁶ This approach would have the corollary effect of narrowing the gap between public and private sector innovation and unifying their efforts.

Strengthening U.S. Intelligence for the AI Age

Today's U.S. Intelligence Community (IC) was designed to fight the Cold War and later successfully adapted to fight the Global War on Terror, but it is ill-suited to support the country's needs in the techno-economic competition in the decade ahead. Historically, the IC has leveraged its unique sources and methods to provide high-level decision-makers with invaluable insights on a focused set of national security threats, particularly regarding strategic advantages for conventional warfare. Driven by the need to guard secrets and protect sources and methods, the IC's reach and impact were constrained, and access to its data was mostly limited to federal government officials with a demonstrated "need to know."

But the world has evolved. Data is now ubiquitous, and the tools and techniques to derive meaningful insights from the world's data are rapidly advancing and becoming widely accessible to all. The key to providing "decision advantage" to policymakers no longer relies just on the possession of secret information, but rather on the ability of intelligence services to swiftly access, process, and deliver timely and actionable insights. While private industry and a growing number of foreign states recognize the trend and are building agile, data-centric systems to support their needs, the IC remains constrained by its culture that prioritizes collecting and protecting secrets.

At the same time, the nature and scope of the threats facing the nation have changed and expanded. The United States and its allies now regularly suffer foreign attacks. Relatively few of these are physical attacks by military or terrorist organizations; most come in the form of cyber intrusions, theft of intellectual property or proprietary technologies, disinformation campaigns, or attempts to interfere in elections and the democratic process. And the list of targets — the country's "attack surface" — has expanded well beyond U.S. government and military organizations to include individuals, private sector companies, academic institutions and research

⁸⁶ <u>75th Innovation Command</u>, U.S. Army Reserve (last accessed 2024); <u>Marine Innovation Unit</u>, U.S. Marines (last accessed 2024); <u>Education with Industry Program</u>, Air Force Institute of Technology (last accessed 2024).

labs, state and local authorities, and civil society groups — many of whom enjoy little to no support from the IC.⁸⁷

If the United States and its allies are to prevail in the coming decade, the IC must fortify its position as the nation's first line of defense and key source of strategic advantage. The IC must undergo a fundamental transformation, moving away from its current highly centralized and insular business model to one that embraces collaboration and innovation by design. In addition to its traditional national security mission, the IC should prioritize protecting the country's technoeconomic resources and capabilities while also gaining a deep understanding of those held by our adversaries. Additionally, the IC must focus on countering foreign malign influence operations targeting our information space, acknowledging the significant impact these actions can have on our society's trust in democratic institutions.

The IC should aim to provide information and insight to a wider range of government and nongovernment customers, including the public, on a broader set of national competitiveness and cross-cutting issues. While continuing to cultivate its unique, classified sources and methods, the IC must significantly enhance its ability to gather information from open and commercial sources using machine learning, artificial intelligence, and other advanced data analysis tools. Rather than relying on "secrets" as its sole source of value, the IC would better serve the nation's purpose by acting as a bridge between the government, private sector, and allied nations to address the full array of complex technological, economic, and societal challenges ahead.

Recommendation 11

Enhancing Techno-Economic Intelligence

Broaden the IC's mission to include protecting the elements of national competitiveness and strengthen the IC's ability to collect and analyze techno-economic intelligence.

The IC must strengthen its ability to deliver techno-economic intelligence. To do so, the IC will need to expand its focus beyond what has traditionally been considered within the scope of national security to broader issues of national competitiveness. U.S. leaders should be able to count on the IC to provide in-depth assessments of PRC, Russian, Iranian, and North Korean trade and investment flows, detailed insights on their key companies and critical supply chains, and rich analyses of their technological advancements. U.S. intelligence will also need to understand foreign competitors' emerging platforms in technology and finance, especially as these data-

⁸⁷ Cortney Weinbaum, et al., <u>Options for Strengthening All-Source Intelligence</u>, RAND Corporation (2022).

collecting, strategic platforms are exported abroad.⁸⁸ The IC should establish a National Techno-Economic Intelligence Center to analyze economic, financial, and technological intelligence and coordinate economic threat information.⁸⁹ Like an techno-economic equivalent of the National Counterterrorism Center, this center would warn of foreign threats to the U.S. economy, make sense of rivals' grand strategies, apprise the U.S. industry about threats such as intellectual property theft and supply chain vulnerabilities, and evaluate opportunities to deploy tools of economic leverage.⁹⁰

To be fully effective, the IC must have the legal authorities and incentives to perform technoeconomic net assessments that would enable policymakers to weigh the United States' comparative advantage — or disadvantage — in a particular technology. This would require the IC to expand its partnerships with U.S. companies and research organizations, and those of our allies, that are the key sources for technical insights or have the necessary connections to foreign suppliers and competitors.



Protect Against Foreign Malign Influence

Devote more IC resources toward protecting the country from foreign malign influence campaigns.

The IC must also make efforts to more effectively protect the country from the harms caused by foreign malign influence efforts. Our adversaries are weaponizing existing social media platforms and utilizing generative AI to produce false and misleading information, interfere in democratic elections, and undermine social cohesion.⁹¹ Technological advancements and the emergence of new media platforms have enhanced the speed, reach, volume, and persuasiveness of disinformation generated by foreign adversaries. The IC's creation of the Foreign Malign Influence Center (FMIC) in 2022 was a good start,⁹² but its analysis and coordination functions need to be augmented with operational authorities and technical

⁸⁸ Anthony Vinci, <u>Competitive Climate: America Must Counter China by Investing in Economic Intelligence</u>, The National Interest (2020).

⁸⁹ Intelligence in An Age of Data-Driven Competition, Special Competitive Studies Project (2022). The new Center would build upon, and perhaps replace, the DNI's Office of Economic Security & Emerging Technology and the analytic components of CIA's Transnational and Technology Mission Center.

⁹⁰ John Costello, et al., <u>From Plan to Action: Operationalizing A U.S. Technology Strategy</u>, Center for a New American Security (2021).

⁹¹ Ali Swenson & Kelvin Chan, <u>Election Disinformation Takes a Big Leap with Al Being Used to Deceive Worldwide</u>, AP News (2024).

^{92 50} U.S.C. §3059.

capabilities to detect, monitor, and — when directed — thwart disinformation campaigns launched by foreign actors at their source. FMIC should also produce public warnings when foreign malign influence attacks occur and provide tailored intelligence support to U.S. entities that are targeted.⁹³

A first step would be for the DNI to amend Intelligence Community Directive (ICD) 191 that establishes that IC agencies currently have a "duty to warn" U.S. and non-U.S. citizens only when it uncovers threats of violence.⁹⁴ This should be expanded to require IC agencies to warn U.S. persons and entities of critical, non-violent threats — including intellectual property theft, targeted disinformation campaigns, or cyberattacks — that are harmful to our democratic system and economic well-being.

Beyond helping to defend the country's information space — by identifying, tracking, and countering foreign malign influence platforms, operators, and message payloads — the IC ought to play a more active role in supporting U.S. strategic messaging to counterbalance false and misleading narratives being put forward by Russia, the PRC and other authoritarian groups. This starts with putting more emphasis on sharing information and insights — not just a narrow slice of classified intelligence — with allies and like-minded nations and non-state entities on a wide range of cross-cutting issues. A new Deputy Director of National Intelligence for Strategic Partnerships should drive this more proactive approach toward developing common information environments with allies, and the IC should be directed to share more of its assessments with allies, particularly those on the front lines of strategic economic competition with the PRC.

Recommendation 13

Expand The Use of Open Source Intelligence

Establish a new open source agency and pair it with a non-profit public foundation that organizes private sector open source data providers into a consortium.

The U.S. Government should stand up a new agency that is entirely focused on OSINT, consolidating capabilities currently dispersed across CIA, DIA, NGA, and other civilian agencies. It could be placed either inside the IC or outside — there are sound arguments in favor of each path — but regardless of its position within government it should be staffed by experts on OSINT datasets and tradecraft, and virtually all of its work should be performed in an unclassified environment. The organization's aim should be to bring data and capability to the IC and other

⁹³ Alexander Aguilastratt, et al., <u>The Information Domain and Social Media: Part I</u>, NCO Journal (2022).

⁹⁴ ICD 191, <u>Duty to Warn</u>, U.S. Office of the Director of National Intelligence (2015).

U.S. departments and agencies for substantive experts to make use of and to inform collection strategies. Pairing the new agency with a nonprofit foundation (akin to In-Q-Tel) that would curate and organize private sector vendors and data suppliers would speed delivery of capability and reduce costs.⁹⁵

The IC will not be able to enjoy the full benefits of OSINT unless it takes a radically different approach to data. The need to protect sensitive sources and methods will not go away, nor will the requirement to keep some datasets siloed, but the IC needs to pivot toward designing its data architectures in a way to foster and promote federated datasets so that it can operate at speed and scale. Likewise, the IC needs to fully embrace the use of large language and multi-modal AI models and machine learning to extract insight for the data it has. The goal should not be to replace intelligence collectors or analysts, but rather to construct human-machine teams that together are able to accomplish much more than humans or machines alone.

Build the Next Generation of Alliances

The global network of Alliances the United States has built since the end of World War II, and the degree of integration we have in values, capabilities, and operations, is unparalleled in the history of humanity. This is a core strength our nation and our allies hold over any competitor or adversary, and one we should continue to build out to advance our interest in peace, stability, and prosperity around the world.

However, we constructed our present network of alliances to handle an array of regional challenges that manifested during the preceding decades. As the geography of strategic and technology competition becomes global, we must rethink and reinvent our alliances.



Foreign Policy. Active promotion of democratic values, human rights, and the rule of law is not merely idealistic; it is a strategic imperative for shaping a world order conducive to our interests. We must leverage multilateral forums like the G7+, bilateral engagements, and support for civil society to counter authoritarian narratives, promote good governance, and foster resilient

⁹⁵ Intelligence Innovation: Repositioning for Future Technology Competition, Special Competitive Studies Project (2024).

democracies. This includes targeted initiatives to bolster independent media, strengthen anticorruption efforts, and support human rights defenders in partner nations. We must also not shy away from actively and directly promoting these values with populations inside adversarial and rival nations. Additionally, we must utilize platforms like the Global Initiative on Critical Emerging Technology (GiCET) to shape global technology standards, counter digital authoritarianism, and protect critical infrastructure from cyber threats. This involves promoting open, interoperable technologies, developing secure supply chains for emerging technologies, and countering disinformation campaigns.

Defense. Interoperability is no longer sufficient in an era of rapid technological change and multidomain warfare. We must forge a truly integrated and interchangeable alliance defense posture, encompassing joint planning, training, capability developments, and operations across all domains. This includes leveraging AI, autonomous systems, and seamless data exchange to present a credible, unified deterrent against aggression. At the same time, maintaining our military advantage as allies requires sustaining robust and agile defense industrial bases, fostering collaborative research, development, and procurement of advanced technologies. We must prioritize interchangeability, shared standards, and rapid innovation cycles, investing in emerging technologies like hypersonics, directed energy weapons, and quantum computing, while ensuring responsible development and use. Capacity building among allies and partners is essential for burden-sharing and regional stability. We must tailor our assistance to their specific needs, providing training, equipment, intelligence support, and cyber defense capabilities, while fostering regional security architectures through integrated execution.

Intelligence. Expanding intelligence sharing and forging new intelligence relationships, particularly in open-source data, emerging technologies, and joint collection efforts, is vital for maintaining information dominance against the threats we are facing. Developing shared threat assessments, based on rigorous analysis and diverse perspectives, will guide coordinated action against common adversaries, including identifying emerging threats, assessing vulnerabilities within our alliance network, and developing proactive strategies to mitigate risks. Strengthening efforts to detect and counter espionage, cyberattacks, predatory trade and economic espionage, and other malicious activities aimed at our alliance network is critical. We must share information, best practices, and cutting-edge technologies to enhance our collective resilience and protect sensitive information. And similar to our defense efforts, the intelligence community should also consider developing new capacity-building programs that it could leverage to strengthen existing liaison relations and to pursue new ones.

Economic. Mobilizing the economic power of the free world is essential to winning the technology competition. Tasks like diversifying value chains, screening risky investments, and protecting sensitive data and critical infrastructure demand coordinated action. Beyond playing defense, we must also work together to outmatch the arsenals of autocracy by coordinating not only on

technology priorities, but also on action plans⁹⁶ that translate these priorities into realities in the market and on the battlefield. This requires assessing our competitive advantages, taking a divide-and-conquer approach to lists of critical technologies, and aligning public-private investments to ensure democratic leadership. Equally crucial is reinvigorating the appeal of our democratic market values globally. We must make the case to nations who are sitting on the fence: innovation thrives where freedom abounds, and transparent, accountable government is the most proven path to prosperity and resilience.

⁹⁶ SCSP has developed a series of such plans. See, for example, <u>National Action Plan for U.S. Leadership in Advanced</u> <u>Networks</u>, Special Competitive Studies Project (2023); <u>National Action Plan for U.S. Leadership in Advanced Compute &</u> <u>Microelectronics</u>, Special Competitive Studies Project (2023).

Pillar 3: Catalyze Enduring Economic Advantage in the Al Era

By many measures, the United States is poised for economic preeminence in the twenty-first century. America has favorable demographics, a diverse and productive labor force, and continues to attract the world's top talent. It is home to the most valuable companies on the planet and has the deepest and most liquid capital markets, while the U.S. dollar continues to enjoy global reserve currency status, granting the United States significant financial power. Compounding these advantages, the United States maintains an unrivaled network of allies and partners, with fellow democracies accounting for more than 60 percent of global gross domestic product (GDP).⁹⁷ Meanwhile, the U.S. innovation ecosystem continues to propel the U.S. economy forward, boosting productivity and economic growth in a time of rising geopolitical turbulence and macroeconomic uncertainty.

U.S. firms and research outfits are spearheading the AI revolution, conferring tremendous longrun benefits on the United States. Generative AI has already diffused widely across the enterprise software sector and shifted the boundaries for scientific discovery. As the decade progresses, AI will increasingly shape the world of hardware, accelerating the pace of innovation in deep technology sectors like robotics, biotechnology, advanced manufacturing, and nuclear energy.⁹⁸ The United States has a once-in-a-century opportunity to leverage its lead in software and AI to create durable advantages in these fields, boosting productivity and economic growth.

This window of opportunity comes at a pivotal time. For all its economic advantages, the nation remains inadequately positioned for long-term competition for market share in strategic technology sectors. These "advanced industries," from aerospace to biotechnology and microelectronics, are vital to the U.S. economy: they account for the majority of U.S. exports and R&D, provide large numbers of high-wage STEM jobs, and make an outsized contribution to U.S. GDP.⁹⁹ Leadership in these industries also offers strategic benefits. Production capacity for key inputs and technology platforms creates leverage to advance domestic and foreign policy priorities, deter adversaries, and fight and win wars. Yet decades of outsourcing have eroded the nation's ability to produce key technologies at home, contributing to workforce shortages across strategic sectors in the process.

Compounding matters, the fracturing of the post-Cold War economic order is forcing policymakers to confront the challenges posed by China's dominance in advanced industries.

⁹⁷ Sharmin Mossavar-Rahmani & Brett Nelson, <u>America Powers On</u>, Goldman Sachs (2024); Tim Orlik, et al., <u>A Third of</u> <u>Global GDP Now Generated in Non-Democracies</u>, Bloomberg (2022).

 ⁹⁸ Arnaud de la Tour & Massimo Portincaso, et al., <u>Deep Tech: The Next Wave of Innovation</u>, Boston Consulting Group (2021).
⁹⁹ Mark Muro, et al., <u>America's Advanced Industries: What They Are, Where They Are, and Why They Matter</u>, Brookings (2015).

Between 1998 and 2020, the PRC's share of global output in these sectors grew from 3 percent to 25 percent.¹⁰⁰ Much of this growth has come at the expense of the United States and its allies and partners. Despite economic headwinds, the PRC continues to devote staggering amounts of resources to increase market share in strategic industries, doubling down on mercantilist policies that entrench China's position by flooding global markets with subsidized exports.¹⁰¹ Meanwhile, the CCP continues to cultivate partnerships with autocratic regimes, including Russia and Iran, which receive critical material support and diplomatic cover from Beijing.

The United States must position itself for competition for market share in advanced industries. This will require implementing a coherent, long-term techno-industrial strategy¹⁰² that promotes technology diffusion — the key driver of long-term productivity growth — and addresses key national security gaps, such as the erosion of the U.S. defense industrial base. Such a strategy must be pursued in a focused, sustained, and apolitical way, and will require building or overhauling institutions associated with economic competitiveness to ensure they are fit for purpose. It will require targeted action across three interlocking areas.¹⁰³

First, the United States can rebuild lost production capacity by making major investments in advanced manufacturing technologies. Advanced manufacturing is ground zero for the technological convergence between bits and atoms. Leveraging technologies such as industrial AI, robotics, and additive manufacturing to drive production in a direction that is more distributed, flexible, and sustainable can begin to offset China's advantages in scale-based manufacturing. These efforts should be supported by technology and policy moves in advanced networks, which will be needed to provide connectivity for intelligent assets on the factory floor.

Second, competitiveness will require deepening strategic trade and investment relationships with allies and partners centered around key technology battlegrounds. Friendshoring production can provide alternative access to sources of supply for critical technology inputs, while signing targeted trade agreements is necessary to open additional markets for goods produced by firms in the United States. Moreover, the United States and key allies and partners, recognizing the risks of technology entanglement with an adversary, must continue to employ targeted measures to limit China's access to strategically significant technologies and markets.

¹⁰⁰ Robert D. Atkinson & Ian Tufts, <u>The Hamilton Index, 2023: China Is Running Away With Strategic Industries</u>, Information Technology & Innovation Foundation at 9, 14 (2023).

¹⁰¹ Edward White & Cheng Leng, <u>Will Xi's Manufacturing Plan Be Enough to Rescue China's Economy?</u>, Financial Times (2024).

¹⁰² This chapter builds on and updates proposals from SCSP's original techno-industrial strategy and provides new assessments and recommendations to account for technological and geopolitical changes since that strategy's publication in 2022. See <u>Restoring the Sources of Techno-Economic Advantage</u>, Special Competitive Studies Project (2022).

¹⁰³ Robert D. Atkinson, <u>How to Win the Economic War With China</u>, International Economy (2023).

Third, the nation must ensure its workforce can compete in an era characterized by the convergence of physical and digital technologies. Currently, America's domestic workforce development ecosystem and immigration programs are not designed or resourced to win the talent competition. Regaining U.S. advantage will require reimagining how we train domestic talent, recruit and retain international talent, and empower workers to adapt to accelerating technological change. It must also involve harnessing the power of AI to equalize access and opportunity for all Americans. Both digital and AI skills, as well as trade skills, will matter in the economy of the future.

America Builds: Production Capacity as Geopolitical Power

Positioning the United States for leadership in advanced industries requires revitalizing the U.S. techno-industrial base. A foundational element of national power, production capacity in advanced industries underpins the United States' ability to compete across key technology battlegrounds and, if necessary, prevail in protracted conflict.

Recent years have seen significant investment in strategic high-tech industrial sectors, from microelectronics to clean energy. Despite this momentum, however, the United States continues to lag behind China in terms of technology-intensive manufacturing capacity, with waning market share in advanced industry segments that matter for economic competitiveness and national security, including machinery, electrical equipment, EV batteries, pharmaceuticals, chemicals, and maritime hardware. Since entering the World Trade Organization (WTO) in 2001, the PRC has risen to become the world's dominant advanced industrial superpower, posing significant challenges to U.S. and allied economic competitiveness and security.¹⁰⁴



Pillar 3

Organize for Advanced Manufacturing Leadership

Develop a national approach to pursuing U.S. leadership in advanced manufacturing, backing it with necessary resources and policy coordination and leveraging public-private partnerships.¹⁰⁵

¹⁰⁴ Rush Doshi, <u>The United States, China, and the Contest for the Fourth Industrial Revolution</u>, Brookings (2020).

¹⁰⁵ SCSP will expand on proposals to do so in its National Action Plan to Ensure U.S. Leadership in Advanced Manufacturing, forthcoming in 2024. The report is next in a series of action plans to "ensure U.S. leadership in key technology areas."

When the United States organized its innovation system after World War II, the nation accounted for half of the world's total manufacturing capacity.¹⁰⁶ But decades of outsourcing have eroded U.S. production capacity, severing the link between innovation and production. Recent years have seen growing efforts to re-establish this link by building out the institutional infrastructure required to restore the U.S. industrial commons. Unfortunately, the core national programs that anchor the U.S. production innovation system — Manufacturing USA and the Manufacturing Extension Partnership (MEP) — remain underfunded by an order of magnitude compared to other industrialized economies. These programs will need to be resourced as national strategic assets if the United States is to lead in advanced industries of the future.¹⁰⁷

In addition to funding core programs, the United States should ensure better coordination of government resources for advanced manufacturing programs at all levels. For example, this could include establishing a White House Advanced Manufacturing Office, backed by a dedicated staff and institutional resources to drive strategic alignment among the various manufacturing-related initiatives, and institutions.¹⁰⁸ Moreover, the Department of Commerce could appoint a panel of outside experts in a Commerce Innovation Board, modeled on the Pentagon's Defense Innovation Board, to advise the Department of Commerce on innovation and industrial policy.

Recommendation 2

Accelerate Adoption of Advanced Manufacturing Technologies

Incentivize the deployment of advanced manufacturing technologies at scale to increase U.S. manufacturing productivity and industrial capacity.

Advanced manufacturing involves the application of computation, sensing, and networking technologies to production processes, creating highly integrated cyber-physical systems that can produce goods smarter, faster, and more sustainably.¹⁰⁹ Establishing national-level objectives — such as building 1,000 software-defined, intelligent factories — would jumpstart efforts to dramatically boost U.S. industrial base capacity. These facilities would capitalize on U.S. software advantages to compete on cost, customization, and rapid production innovation.

¹⁰⁶ Melvyn Leffler, <u>The Emergence of an American Grand Strategy</u>, <u>1945-1952</u>, Cambridge University Press (2010).

¹⁰⁷ David Adler & William B. Bonvillian, <u>America's Advanced Manufacturing Problem—and How to Fix It</u>, American Affairs Journal (2023).

¹⁰⁸ William B. Bonvillian, Ensuring Manufacturing USA Reaches Its Potential, Day One Project at 9 (2021).

¹⁰⁹ Chandrakant D. Patel & Savi Baveja, <u>The Rise of Cyber-Physical Systems</u>, National Academies of Sciences (2023).

Beyond driving the creation of large-scale factories of the future, there is an urgent need to democratize, domestically, the access to advanced manufacturing technologies. Small- and medium-sized manufacturers (SMMs) are the backbone of the U.S. manufacturing sector, but lag behind in terms of technology adoption.¹¹⁰ A revitalized MEP program, for example, could serve as a system integrator, helping SMMs to deploy technologies like industrial AI and robotics. In addition, policymakers should make it a strategic priority to close capital access gaps for SMMs seeking to pursue digital transformation.



Tremendous amounts of capital are required to take technologies from prototypes to products that are manufactured at scale. But the time horizons of many private investors often do not align with manufacturing business models — unless governments can absorb a share of the risk. The United States should explore the establishment of new public-private financing mechanisms, and the augmentation of existing authorities, for funding techno-industrial enterprises. Providing scale-up financing for technology-intensive manufacturing firms will prove critical to competing for global market share in advanced industries with other advanced economies and the PRC.^{III}

To meet this need, the United States should leverage and expand existing authorities, such as the Export-Import Bank's Make More in America Initiative and the Defense Production Act, to provide direct assistance for domestic producers. The United States should also consider establishing new financing mechanisms, such as blended funds, which would leverage public funding to de-risk private investment in capital-intensive enterprises.¹¹² Finally, U.S. policymakers should also explore opportunities to work with allies and partners on these efforts.

¹¹⁰ Elisabeth Reynolds, et al., <u>Digital Technology and Supply Chain Resilience: A Call to Action to Accelerate U.S.</u> <u>Manufacturing Competitiveness</u>, Massachusetts Business Roundtable & Manufacturing@MIT (2023).

^{III} Peter L. Singer & William B. Bonvillian, <u>"Innovation Orchards": Helping Tech Start-Ups Scale</u>, Information Technology and Innovation Foundation (2017).

¹¹² For financing mechanisms that support the research and development of technologies at pre-commercialization stages, see Pillar 1 of this report.

Recommendation 4

Construct Secure, Next-Generation Digital Infrastructure

Deploy next-generation digital infrastructure that is cyber-hardened against threats from malign actors.

While PRC producers won the first round of the competition for leadership in advanced networks by deploying 5G hardware globally, the next round of competition is just beginning.¹¹³ Deploying advanced manufacturing technologies, especially industrial AI systems, will require building out the requisite advanced networking technologies domestically and with trusted partners. The United States, working with allies and partners with complementary strengths, must catalyze the development of network core, radio access network (RAN), Internet of Things (IoT), and satellite components in order to protect its industrial infrastructure from dependence on PRC-produced technologies, while also placing further restrictions on components made in countries of concern.¹¹⁴

Malicious actors can also target cyber-physical systems from a rapidly growing number of threat vectors beyond compromised networks. Ensuring cyber-physical systems are secure and defensible will require promoting transparency and provenance across an entire system — from the software codebases and AI training datasets to hardware components.¹¹⁵ And as adversaries deploy increasingly powerful AI systems for autonomous cyber operations, keeping up will require developing and deploying AI-enabled cyberdefenses at scale.¹¹⁶

Strength In Numbers: Market Alliances and Economic Statecraft

Decades of outsourcing have left democratic market economies heavily reliant on the PRC for critical technology inputs and advanced industrial capacity. According to one estimate, the United States and its allies annually import \$1 trillion worth of strategically critical goods from China and states in its orbit, out of \$5 trillion sourced globally.¹¹⁷ For years, Beijing has exploited the dynamism and openness of market economies, employing a range of brute force tactics to displace global competitors in strategic industries. These actions and others undermine U.S.

 ¹¹³ Jon Pelson & Warren Wilson, <u>Round Two of the 5G Battle Is Just Beginning. Can America Surge Ahead?</u>, Medium (2023).
¹¹⁴ Know All About Open RAN Trials, <u>Deployments Happening Globally</u>, Economic Times Telecom (2023).

¹¹⁵ See, e.g., <u>System of Trust Framework</u>, MITRE (last accessed 2024).

¹¹⁶ Catherine Stupp, <u>AI Helps U.S. Intelligence Track Hackers Targeting Critical Infrastructure</u>, The Wall Street Journal (2024).

¹¹⁷ <u>The Geoeconomic Implications of the Fractured Global Economy</u>, Fathom Consulting (2024) (SCSP-commissioned work product). The report uses case studies and an econometric model to predict geopolitical alignment.

national security and economic competitiveness by eroding domestic advanced industrial capacity and ceding technological know-how.

Recent developments in the international economic environment present the United States with opportunities to recalibrate its strategic posture and, in particular, alleviate dependence on the PRC. U.S. market demand alone for emerging technologies represents roughly a third of global technology spending, providing the United States with leverage that can be multiplied by working with other democratic market economies.¹¹⁸ By deepening trade relationships, democracies can pool their market demand, mitigating dependence on adversaries while providing new markets for exports.¹¹⁹ To win, the United States must build a values-aligned trade architecture while organizing government institutions for enduring rivalry.

Recommendation 5

Strengthen Techno-Economic Partnerships with Allies

Build strategic trade alliances with democratic market economies to counterbalance the PRC's economic leverage and ensure democratic access to critical technology inputs.

Democratic market economies in Asia and Europe are home to some of the world's most robust technology innovation ecosystems and offer substantial markets for U.S. technology exports. The United States should establish strategic trade agreements with allies and partners,¹²⁰ creating a resilient ecosystem that provides access to upstream components and pooling market demand in critical sectors. Targeted sectoral arrangements with key allies and partners – starting with countries such as the United Kingdom, Japan, the Republic of Korea, and Taiwan – can be forged to secure supply chains and lower costs for key inputs such as IoT modules, networking components, and critical minerals.¹²¹ Particular attention should be paid to securing electronic components powered by legacy microelectronics, given their outsized role in critical infrastructure sectors around the world.¹²² Decision-makers should also prioritize establishing

¹¹⁸ <u>Software and Information Technology Industry</u>, Select USA (last accessed 2024).

¹¹⁹ Robert D. Atkinson & Liza Tobin, <u>The Missing Piece in America's Strategy for Techno-Economic Rivalry with China</u>, Lawfare (2023).

¹²⁰ For example, the United States could look to upgrade its existing agreements with Japan and South Korea, and pursue new bilateral trade agreements with the United Kingdom, Taiwan and India. See e.g., Matt Pottinger & Mike Gallagher, <u>No</u> <u>Substitute for Victory</u>, Foreign Affairs (2024); Clete R. Willems, <u>It's Time For a US-Taiwan Free Trade Agreement</u>, Atlantic Council (2024

¹²¹ Clete R. Willems, <u>It's Time For a US-Taiwan Free Trade Agreement</u>, Atlantic Council (2024); Peter Harrell, <u>How to Save</u> <u>Free Trade</u>, Foreign Affairs (2024).

¹²² <u>National Action Plan for U.S. Leadership in Advanced Compute & Microelectronics</u>, Special Competitive Studies Project at 34-36 (2023).

digital trade rules with allies and partners to govern cross-border data flows, promote interoperability, and safeguard sensitive information from foreign exploitation.

In addition to advancing bilateral trade agreements, the United States must foster the emergence of a new, technology-focused trade architecture built for an era of competition. The WTO has not demonstrated an ability to hold Beijing accountable for its transgressions. The PRC has systematically undermined industries in the United States and other democratic market economies via a range of exploitative tactics including forced technology transfer, IP theft, unfair state aid, and preferential treatment, without a serious response from the WTO, which is hampered by its global membership. Instead of abandoning the institution, the United States should work with like-minded partners to incrementally establish a trading framework that lowers thresholds for rule-of-law, market economies; increases barriers for bad actors; and facilitates flows of technology and trade among market economies. This architecture follows the traditions of the General Agreement on Tariffs and Trade (GATT) – the Cold War-era precursor to the WTO – which was intended as a trading body for market economies under the rule of law.¹²³ Under this framework, managed economies such as then-Communist Poland and Romania were not entirely cut out, but were offered the prospect of managed trade.¹²⁴ Similarly, a "GATT 3.0" would prevent bad actors from exploiting access to democratic market economies.

Finally, to deepen foreign markets for U.S. emerging technology exports, the United States should establish a Tech Export Accelerator to boost American technology flows to allies and partners.¹²⁵ Staffed by specialists knowledgeable about U.S. government financing and commercial advocacy tools and relevant foreign markets, this "one-stop shop" would work hand in hand with U.S. companies and overseas missions to identify major project opportunities, support proposal development, and drive sales across the finish line.



¹²³ SCSP would like to thank Daniel Crosby for this insight. See also Donald Clarke, <u>GATT Membership for China?</u>, University of Puget Sound Law Review (1993).

¹²⁴ GATT Treatment of Nonmarket Economy Countries. U.S. Government Accountability Office at Appendix I (1990).

¹²⁵ For more on the Tech Export Accelerator, see <u>Restoring the Sources of Techno-Economic Advantage</u>, Special Competitive Studies Project at 73 (2022).

To date, U.S. responses to China's brute force economic tactics have been case-by-case and largely reactive. In an era where the PRC is weaponizing economic interdependence to gain a stranglehold on strategic industries, the United States must reset the terms of the bilateral economic relationship.¹²⁶ In particular, trade authorities like Section 301 and Section 232 allow for unilateral action against a wide range of unfair practices, from IP theft to market-distorting subsidies.¹²⁷ Officials must continue to make creative use of these tools to counter malign statecraft practices that threaten U.S. national and economic security.

Recent years have seen growing use of export controls to restrict adversaries' access to dual-use technologies. To maximize the efficacy of these controls, the United States should further empower the Department of Commerce by strengthening licensing policy, boosting enforcement capacity, and accelerating the adoption of AI and open-source intelligence tools. Moreover, the Department of Commerce should develop and apply sector- or country-wide controls that cover entire sectors, eliminating loopholes that adversaries have managed to exploit. These steps must be complemented by creation of a plurilateral export control regime, in conjunction with allies and partners, focused on a range of battleground technologies.¹²⁸

Recommendation 7

Build U.S. Economic Institutions Fit for Strategic Competition

Implement institutional reforms to position the United States for sustained techno-economic competition with the PRC.

As international economic policy continues to become critical to national security, the United States needs a coordinated national approach to economic security. First, the President should appoint a White House lead for economic security, responsible for coordinating the use of economic statecraft tools across the interagency. This lead, dual-hatted between the National Security Council (NSC) and the National Economic Council (NEC), would lead the development of a National Economic Security Strategy.¹²⁹ The strategy would set strategic objectives and coordinate the use of tools such as export controls and sanctions, alongside other levers of national power such as diplomacy and economic incentives, to ensure maximum effectiveness and a holistic national approach and messaging.

¹²⁶ Matt Pottinger & Mike Gallagher, <u>No Substitute for Victory</u>, Foreign Affairs (2024).

¹²⁷ Andres B. Schwarzenberg, <u>Section 301 of the Trade Act of 1974</u>, Congressional Research Service (2024), Rachel F. Fefer, <u>Section 232 of the Trade Expansion Act of 1962</u>, Congressional Research Service (2022).

¹²⁸ <u>Restoring the Sources of Techno-Economic Advantage</u>, Special Competitive Studies Project at 56 (2022).

¹²⁹ Henry Farrell & Abraham Newman, <u>The New Economic Security State</u>, Foreign Affairs (2023).

Second, the United States must equip its economic institutions for strategic competition by deploying technology tools and making targeted organizational moves. Rapid advancements in commercially available AI-enabled platforms, for example, can help government teams analyze vast quantities of supply chain data to detect chokepoints and enforce restrictions. Organizations on the front lines of economic competition — such as the Department of Commerce's Bureau of Industry and Security (BIS) and International Trade Administration (ITA), as well as the U.S. Trade Representative (USTR) and the International Trade Commission — must be staffed and resourced to conduct comprehensive techno-industrial analyses, map U.S. and foreign innovation ecosystems, and identify economic vulnerabilities and chokepoints.

Enduring Advantage: Winning the Talent Competition

The United States and China are locked in a global competition for technical talent that carries strategic implications for future innovation and growth. There is evidence that China is gaining ground in the talent competition: one recent analysis showed that the PRC increased its share of top AI research talent from 11 percent to 28 percent between 2019 and 2022, while the share of top AI research talent working in the United States dropped from 59 percent to 42 percent.¹³⁰ The United States also suffers from talent shortages across its advanced industries, with acute shortages in strategic sectors such as defense industrial base, manufacturing, and semiconductors. Ultimately, the country that can train, recruit, and retain the world's top talent will gain an outsized advantage across both innovation and production.

At the same time, the world has entered a technological revolution that will transform the workforce and usher in a new global economy. At present, the U.S. education, workforce, and immigration systems are neither designed nor resourced to ensure the nation wins the talent competition. A U.S. techno-industrial strategy must include significant investments in the human capital needed to build a resilient industrial base — guided by data and analysis on the mix of technical and non-technical skills in demand — while ensuring all Americans can access reskilling and upskilling opportunities.

Recommendation 8

Make All K-16 Classrooms AI-Equipped by 2030

Prepare all Americans to compete and succeed in an economy transformed by Al.

¹³⁰ Defined by the country share of where the top 20 percent of AI researchers work. See <u>The Global AI Talent Tracker</u>, Macro Polo (2024).

A future where U.S. talent leads globally starts with setting up learners for success early. All students need early exposure and access to the latest technologies, including Al. Al tools can provide customized education, problem solving techniques, and upskilling for learners of all ages and match teachers, students, and school districts to experiential learning opportunities, mentors, and the latest educational resources. Although a considerable amount of educational technology, including Al-enabled learning, is already on the market, it is not equitably accessible or leveraged across public school districts.¹³¹

The United States must bring AI into classrooms to prepare all Americans for an AI-enabled future. This could involve leveraging existing federal programs and novel grant competitions to provide dedicated resourcing for states to integrate AI-enabled educational technology into all public K-16 classrooms. Additionally, professional development programs for educators and incentives for industry to lend AI, cyber, and emerging technology practitioners to schools would increase the relevance and quality of AI education. But in order to succeed, these national programs must also be paired with robust efforts to teach AI principles and responsible use.

Recommendation 9

Develop a National Approach to the Advanced Industry Workforce

Establish more pathways into high-skill careers by reimagining critical skills apprenticeships, creating stackable credentials, and offering AI-enabled job matching.

A variety of studies and anecdotal reports indicate that advanced industries in the United States are experiencing crippling workforce shortages.¹³² However, there is no official national data on supply and demand for skills and competencies across the U.S. workforce, hindering attempts to invest systemically in education programming and workforce planning at the national, regional, and local level. A lack of actionable data also fosters inertia toward avoiding necessary reforms and limits incentives toward creating pathways into high-demand, high-wage careers outside of a traditional four-year college degree.

A workforce framework and corresponding talent marketplace for critical and emerging technologies can address existing workforce data, credentialing, and talent matching challenges. Such frameworks define the core work roles and responsibilities needed in these fields, along with the associated knowledge, skills, abilities, and tasks for each role to enable workforce

¹³¹ Steven Mintz, <u>Why Most Edtech Fails</u>, Inside Higher Ed (2021).

¹³² America Faces Significant Shortage of Tech Workers in Semiconductor Industry and Throughout U.S. Economy,

Semiconductor Industry Association (2023); <u>2.1 Million Manufacturing Jobs Could Go Unfilled by 2030</u>, National Association of Manufacturers (2021).

development program alignment.¹³³ One example of a role that should be added under this framework is the "Technologist" — a reference to manufacturing workers of the future equipped with the skills to succeed in highly dynamic production environments, demonstrating fluency in both digital systems management and traditional manufacturing tasks, such as operating heavy machinery. In addition, the United States should create a national career entry network to scale apprenticeships for advanced industries. Previous attempts to normalize and scale apprenticeships have failed, in part because there is no national network that can enhance the scale and financial viability of local and regional hubs.

Recommendation 10

Pillar 3

Enact High-Skilled Immigration Reform

Ensure the United States remains the destination of choice for the world's best and brightest technical talent.

Leading the techno-economic competition must include being a global beacon for the best and brightest innovators in emerging technologies. In 2022, over half of computer and mathematical scientists and engineers working in the United States were foreign-born.¹³⁴ Research also shows high-skilled immigrants have a significant impact driving U.S. innovation through patent applications and contributions to AI research.¹³⁵ While the United States still leads as a destination of choice for foreign-born STEM talent to study and work, its leadership is in jeopardy, at a time when bipartisan consensus on immigration reform is elusive and other countries are implementing appealing talent recruitment policies.¹³⁶ Losing the lead in attracting foreign-born talent would have significant negative repercussions, as these individuals represent a large portion of U.S. STEM graduate students and are essential to the strength of the U.S. technology sector.

To secure leadership in attracting the world's top talent, the United States must significantly expand the H1-B and O-1 (exceptionally qualified) visa programs for critical and emerging technology skills. It is well-documented that current H1-B visa caps do not adequately meet U.S.

¹³³ The Workforce Framework for Cybersecurity offers a model for this initiative. See <u>Workforce Framework for</u>

<u>Cybersecurity (NICE Framework)</u>, National Initiative for Cybersecurity Careers and Studies (last accessed 2024). See also <u>Cyberseek</u>, (last accessed 2024). Cyberseek is a national talent marketplace that aligns official cyber workforce standards with cyber job openings to enable skills-based hiring.

¹³⁴ <u>The State of Science and Engineering 2024</u>, National Science Foundation (2024).

¹³⁵ Shai Bernstein, et al., <u>The Contribution of High-Skilled Immigrants to Innovation in the United States</u>, National Bureau of Economic Research (2022); Sara Abdulla & Husanjot Chahal, <u>Voices of Innovation</u>, Center for Security and Emerging Technology (2023).

¹³⁶ See Remco Zwetsloot, <u>China's Approach to Tech Talent Competition</u>, Brookings (2020); Jon Marcus, <u>With New 'Talent</u> <u>Visas.' Other Countries Lure Workers Trained at U.S. Universities</u>, Hechinger Report (2023).

employers' immediate high-skilled talent needs, limiting U.S. competitiveness and preventing policymakers from addressing workforce shortages in strategic sectors like microelectronics.¹³⁷ Recent White House actions to address this challenge are a promising start, but ultimately Congress must take action to reform the current system.¹³⁸ The Departments of Homeland Security and State must also be provided with resources to accelerate the current process for visa application and processing.



The challenges affecting the U.S. education and labor ecosystems are well-documented, yet the causes and consequences have little consensus. Both Democratic and Republican administrations have tried to address the leaky STEM talent pipeline, for example, but with mixed or limited success. This status quo imperils U.S. competitiveness as the nation enters a new global economy defined by rapid technological change. The United States should establish a National Commission on the Future of Work¹³⁹ with an action-oriented mission, similar to the National Security Commission on Artificial Intelligence (NSCAI). A Commission would not only analyze the landscape, similar to work done by private and academic institutes like MIT's Work of the Future Initiative,¹⁴⁰ but would have a more direct line to developing policy and legislation.

 ¹³⁷ Andrew Kreighbaum, <u>Tech Layoffs Likely Pose No Deterrent to Record H-1B Visa Demand</u>, Bloomberg Law (2023).
¹³⁸ See Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, The White

House (2023); <u>Biden-Harris Administration Actions to Attract STEM Talent and Strengthen our Economy and</u> <u>Competitiveness</u>, The White House (2022).

¹³⁹ For more on this recommendation, see <u>Building the Generative Economy</u>, Special Competitive Studies Project at 27-28 (2023).

¹⁴⁰ <u>About Us</u>, MIT Work of the Future (last accessed 2024).

ANNEX

Fundamental Designs of the Axis of Disruptors

The Fundamental Designs of Beijing

The Chinese Communist Party's (CCP) overarching goal is to transform the People's Republic of China (PRC) into the leading global power in every domain. This entails eclipsing U.S. influence, weakening U.S. alliances, and demonstrating autocracy's supposed superiority over democracy. Domestically, the Party seeks to maintain its absolute power and control over all spheres of Chinese society: political, economic, military, technological, and cultural. Internationally, the CCP seeks to shape a future where Beijing dictates global dynamics — through its sheer power, via its influence in existing, but weakened or co-opted international institutions, or through new forums that it seeks to establish. Central to their pursuit of these designs are the security apparatus, including the modernizing People's Liberation Army (PLA), and the size of China's market and economy. China has the most ambitious military modernization program in the world. The vast scale of China's economy enables the party to fund this program, invest in large-scale technology development initiatives, and leverage the promise of access to its market to silence critics and compel nations and corporations to align with its preferences.

Political Aspects. The CCP aims to prove that its model of "socialism with Chinese characteristics" is superior to democratic government. It contends that its system — which steers technology and economic resources to advance the Party's goals — provides the path to global supremacy for China and a model for developing nations to achieve prosperity without democracy. However, despite the confidence of its rhetoric, the Party is deeply insecure about its own survival: it spends more on enforcing domestic security and stability than it does on military modernization.¹⁴¹ Its desire for social control manifests itself in measures such as the "Great Firewall," the world's most draconian Internet control system, designed to tightly monitor and censor political content domestically. The party pairs this with sophisticated tech platforms that enable it to shape information domains globally.

¹⁴¹ <u>China Spends More on Controlling its 1.4bn People than on Defense</u>, Nikkei (2022).

Economic Aspects. China's economic leverage — as the world's second largest economy — serves as a key tool for advancing the CCP's global ambitions and achieving geopolitical objectives. Beijing views its decades-long achievement of high economic growth as one of the fundamental underpinnings of the Party's legitimacy and as proof that its autocratic system is better than democracy at delivering development. Since the COVID-19 pandemic, however, Chinese economic growth has slowed¹⁴² at the same time as the United States is experiencing strong growth, presenting the Party with one of the most serious challenges to its legitimacy in decades. China's ability to catch up with and surpass the United States in total economic size, once widely assumed inevitable, has been called into question amid a shrinking population, declining growth drivers (like investment in real estate and infrastructure), and an apparent unwillingness among decision-makers to make the necessary shift toward a more consumer-oriented economy. Despite this, and in pursuit of self-reliance and an alternative growth engine, Beijing is doubling down on support for high-tech manufacturing, which is poised to generate significant industrial overcapacity, distorting global markets in the process.¹⁴³ Left unchecked, China's economic policy direction could undermine nascent attempts in the United States and other advanced economies to rebuild critical defense and commercial production capabilities in strategic sectors, such as semiconductors, clean energy, and electric vehicles.

Military Aspects. The Party's ambition is also reflected in its military modernization program, aimed at turning the PLA into what Xi Jinping calls a "world-class" military,¹⁴⁴ capable of challenging U.S. dominance in the Indo-Pacific and beyond. Spending on the PLA has grown by at least 6.6% per year for the last three decades.¹⁴⁵ The PLA is a "party army" subordinate to the CCP, not the Chinese state. Its primary focus is on deterring or defeating potential adversaries in its region — in particular, the United States — such as in conflicts in Taiwan and the South China Sea. But its global activities are growing to support the Party's ambition of establishing China as global leader in every domain. It seeks to protect China's overseas interests, project power beyond the "third island chain" (encompassing the Aleutian Islands, Hawaii, and islands north of New Zealand), and, over time, establish a global network of military installations.

Innovation Aspects. China has made tremendous strides in science and technology (S&T) in recent decades. Beijing has openly declared its aspiration to become a leading global S&T power, boost its self-reliance, set the pace for future scientific advancements, and dictate global norms. These efforts have yielded results: the PRC is now a major player in many fields, including AI, advanced manufacturing, quantum computing, and biotechnology. In some fields, such as renewable energy, PRC advantages in scale have facilitated noteworthy process innovation,

¹⁴² Stella Yifan Xie, <u>China's Growth Slows to Three-Decade Low Excluding Pandemic</u>, Wall Street Journal (2024).

¹⁴³ Brad W. Setser, et al., <u>China's Record Manufacturing Surplus</u>, Council on Foreign Relations (2024).

¹⁴⁴ Transcript: President Xi Jinping's Report to China's 2022 Party Congress, Nikkei (2022).

¹⁴⁵ <u>China Defense Spending to Climb 7.2% as Xi Pursues Buildup</u>, Bloomberg (2024).
allowing Chinese firms to take the lead.¹⁴⁶ While the Party is significantly increasing investments in building China's innovation power, it is worth noting that Beijing is also tightening its centralized control over the research environment. These simultaneous but opposing dynamics — resource injection on the one hand and great control on the other — could potentially hamper China's achievement of groundbreaking innovations. However, the Party is unlikely to hold back and will seek to correct the imbalance with resource injections and appropriations of foreign intellectual property.

¹⁴⁶ Dan Wang, <u>China's Hidden Tech Revolution: How Beijing Threatens U.S. Dominance</u>, Foreign Affairs (2023).

The Fundamental Designs of Moscow

The Kremlin's driving purpose is to perpetuate Vladimir Putin's hold on power and exert influence on the international stage reminiscent of the power Moscow enjoyed during the Soviet era. Domestically, this centers on dominating the political, economic, and media spaces, avoiding the emergence at all cost of any credible opposition or independent power centers, and fostering a renewed — though highly inflated — sense of Russian greatness and global relevance. Externally, Moscow is opportunistic and does not have a well-defined geographic boundary of influence that it seeks to establish to satisfy its ambitions or to feel secure. This ambiguity makes Russia particularly dangerous. At minimum, it wants to reclaim its influence in the post-Soviet space, break the current world order so as to achieve some parity with the United States, and act with impunity in a multipolar world.

Political Aspects. The Kremlin's foremost political objective is the preservation and perpetuation of the existing power structure and suppression of any challenge to its authority. This encompasses controlling information flows, selectively applying laws and manipulating judicial proceedings, restricting political opposition, and ensuring the socio-economic dominance of the ruling elite. The Kremlin promotes a narrative of Russian exceptionalism, drawing on its long-gone historical grandeur, outdated social values, and co-opted Russian Orthodox Church to legitimize its rule and counter Western narratives.

Economic Aspects. The Russian economic policies are driven by a focus on state control over strategic sectors, particularly the vast natural resource industries. In 2023, oil and gas sales accounted for more than 34% of its total federal budget revenue.¹⁴⁷ This control provides the Kremlin with the financial resources to ensure domestic stability and to support its geopolitical ambitions. The Kremlin also fosters a close partnership with powerful oligarchs to solidify economic support for the regime in exchange for lucrative business opportunities.

Military Aspects. Russia's invasion of Ukraine has led to a rapid reshaping of its military forces. Having lost 90% of its prewar army in the first two years of the war, the Kremlin is nonetheless expanding and reconstituting its conventional forces — aided by significant increases in defense spending and mobilization of its industrial bases. Russia's strategic deterrent remains largely unaffected by the war. Moscow maintains a sizable nuclear weapons arsenal¹⁴⁸ to deter a spectrum of actions from NATO (and China) and to project continued superpower parity with the United States. Additionally, Moscow continues to invest in and effectively use hybrid warfare

¹⁴⁷ <u>Russia's Oil and Gas Budget Revenue Down 24% in 2023</u>, Reuters (2024).

¹⁴⁸ <u>Nuclear Notebook: Russian Nuclear Forces, 2024</u>, Federation of American Scientists (2024).

capabilities, including cyberwarfare and disinformation, allowing it to asymmetrically exploit vulnerabilities and exert influence without needing to resort to direct military confrontation.

Innovation Aspects. Since the collapse of the Soviet Union, the Kremlin has struggled to compete at the leading edge of science and technology, although it continues to maintain a strong domestic talent base in basic sciences and mathematics.¹⁴⁹ Moscow, once the more advanced technological power, historically cemented its military-technical cooperation with Beijing by supplying the PRC with some of its sophisticated weapons systems.¹⁵⁰ Over the past decade, however, the tables have turned, and Moscow now finds itself reliant on Beijing to access more modern technology systems. High on the list of Moscow's priorities is to lessen Russia's reliance on Western technology while mitigating the effects of sanctions. Moscow also exerts extensive control over the digital realm within its borders, using censorship and surveillance capabilities to manage information flows and clamp down on dissent.

 ¹⁴⁹ Dominik Jankowski, <u>Russia and the Technological Race in the Era of Great Power Competition</u>, Center for Strategic and International Studies (2021); Nayanee Gupta, et al, <u>Innovation Policies of Russia</u>, Institute for Defense Analyses (2013).
¹⁵⁰ Dmitry Gorenburg, et al., <u>Russian-Chinese Military Cooperation</u>, CNA (2023).

The Fundamental Designs of Tehran

The Islamic Republic of Iran's core objectives are to preserve its form of government at home and establish Iran as the preeminent power in the Near East, including by ejecting U.S. forces from the region, achieving a balance of power with Israel, and usurping the leadership role of the Islamic world. Iran's rulers — a small cadre of technocrats, military leaders, and business elites overseen by a clerical establishment — leverage brutality at home, a growing conventional military arsenal, state-sponsored terrorism, a broad network of rejectionist Islamic groups, and sophisticated offensive cyber and disinformation capabilities to pursue their objectives.

Political Aspects. The Iranian regime's principal objectives are to become the region's dominant power and to preserve and propagate its unique model of government. Iran's clerical elite and its Revolutionary Guard Corps (IRGC) hold all levers of power under the Supreme Leader. Together, they set the direction and tone of domestic and foreign policy. Tehran seeks to remake the balance of power in the Near East by pressuring the United States and its allies to withdraw from the region, and setting the conditions to balance or overtake Israel as the most powerful country in the region.

Economic Aspects. Iran strives for economic self-reliance to mitigate the impact of sanctions and lessen its reliance on oil exports. It tries to pursue policies aimed at diversifying its economy, fostering domestic industries, and circumventing Western financial restrictions. Since its founding, Iranian leaders have proclaimed their goal of achieving equity and social justice in their political rhetoric. While on the surface the government prioritizes social programs and subsidies for essential goods and services as a means to garner domestic support, economic power is still concentrated in the hands of a small elite, including the security forces such as the IRGC. Through a network of holding companies, front organizations, and "charitable foundations," the IRGC exerts significant influence over the country's construction, telecommunications, and oil and gas sectors. It also uses them to subvert sanctions and covertly export weapons and military technologies to its regional proxies and to Russia.¹⁵¹

Military Aspects. Iran's conventional military doctrine emphasizes a strong retaliatory posture to deter attacks from adversaries, namely, Israel and the United States. Besides its large conventional military force, Tehran's reluctance to completely and verifiably disavow its nuclear program provides it leverage to counter Western pressure. Meanwhile, Tehran emphasizes hard power — including its network of armed proxies and allies across the region and its growing arsenal of medium- and long-range rockets, missiles, and armed drones — to project power and protect its interests in the Near East and beyond. Iran also uses its own defense-related items or

¹⁵¹ Iran's Revolutionary Guards, Council on Foreign Relations (2024).

technical data to build relations, gain diplomatic allies, and indirectly attack the United States interests and personnel.

Innovation Aspects. Tehran prioritizes indigenous scientific and technological development – with a focus on nuclear technology, aerospace, and cyber capabilities¹⁵² – to bolster its self-sufficiency. The Iranian government seeks to maintain strict control over information flows domestically, censoring the Internet and promoting a narrative favorable to the regime. Its development of cyberwarfare capabilities aims to protect against cyberattacks and provide tools to disrupt foreign critical infrastructure.

¹⁵² <u>Annual Threat Assessment of the U.S. Intelligence Community</u>. Office of the Director of National Intelligence (2024); <u>Iran</u> <u>Military Power. Ensuring Regime Survival and Securing Regional Dominance</u>. Defense Intelligence Agency (2019).

The Fundamental Designs of Pyongyang

The Democratic People's Republic of Korea (DPRK) is driven by the overarching goal of regime preservation under the absolute control of the Kim dynasty. This encompasses maintaining a rigidly controlled society, pursuing nuclear weapons for deterrence and extortion, and promoting an ideology of extreme nationalism and self-reliance. Internationally, the DPRK seeks to undermine U.S. influence in the region, secure reunification with South Korea on its own terms, and obtain recognition as a nuclear power.

Political Aspects. The principal design of the Kim regime is to retain and solidify its absolute power within the DPRK. The regime's system is animated by the "Juche" ideology, which enshrines the hereditary rule of the Kim family in the North Korean identity.¹⁵³ The DPRK's international strategy is driven by a deep-seated perception of existential threats from the United States and South Korea. This is then used as an excuse by the Kim dynasty to pursue ever greater military capabilities to guarantee its survival and display its power. The question of succession could pose a threat to the regime, as any transfer of power in a system built on force and intimidation risks triggering a period of instability.

Economic Aspects. The regime seeks to maintain a balance among three interlocking imperatives: pursuing autarky, securing resources for its weapons programs, and sustaining a basic level of material existence for its subjects sufficient to avert a popular challenge to its legitimacy. The regime has a pragmatic recognition of its need for economic improvement to conserve its political stability and avoid undermining the centralized structure of its economy. Its international economic engagements, though limited, are pursued with the dual goals of acquiring essential goods and technologies and circumventing influences that could destabilize the regime. The country's shortage of hard currency compels the Kim regime to rely on a range of illegal activities to fund its weapons programs, including cyberattacks, drug trafficking, and arms sales to Russia for its war in Ukraine.¹⁵⁴

Military Aspects. The regime aims to assert its sovereignty and expand its influence on the Korean peninsula through provocative military maneuvers and robust nuclear and conventional deterrents. Its military doctrine is anchored in the acquisition of nuclear weapons, the development of ballistic missile delivery systems, and the massing of conventional warfighting capabilities on its southern border. This doctrine is intended to ward off alleged foreign encroachment and to coerce diplomatic and economic concessions. The DPRK, having worked on

¹⁵³ Foster Klug, <u>Juche Rules North Korean Propaganda</u>, <u>But What Does It Mean?</u>, Associated Press (2019).

¹⁵⁴ Tom Wilson, <u>North Korean Hackers</u>, <u>Criminals Share Money Laundering Networks in Southeast Asia - UN</u>, Reuters (2024).

two legs of the nuclear triad¹⁵⁵ — intercontinental ballistic missiles and submarine-launched ballistic missiles — seeks to achieve a state of strategic equilibrium through developing the credible threat of catastrophic retaliation.¹⁵⁶ The DPRK's weapons programs also reinforce its political goals to assure its subjects of the nation's strength and ability to thwart an attack by the United States.

Innovation Aspects. Despite an overwhelming sanctions regime, the DPRK regime has exhibited a remarkable capacity for innovation in the military sphere, with clandestine support from foreign partners. In its formative years, the DPRK was the beneficiary of extensive material and technical aid from the Soviet Union and the illicit proliferation network helmed by A. Q. Khan.¹⁵⁷ More recently, and in the face of increased scrutiny, the regime has charted an increasingly indigenous method of innovation. It has also developed modern military technologies, such as improved re-entry vehicles, solid-fuel propellants, and a greater satellite capacity.¹⁵⁸

 $^{^{\}mbox{\tiny 155}}$ l.e., nuclear launch capabilities by air, land, and sea.

¹⁵⁶ As of last year, the state was estimated to have 30 warheads, and enough fissile material to produce 50 to 70 more. <u>Control and Proliferation Profile: North Korea</u>, Arms Control Association (2023).

¹⁵⁷ Balázs Szalontai & Sergey Radchenko, <u>North Korea's Efforts to Acquire Nuclear Technology and Nuclear Weapons:</u> <u>Evidence from Russian and Hungarian Archives</u>, Woodrow Wilson International Center for Scholars (2006); Mike Chinoy, <u>How Pakistan's A.Q. Khan Helped North Korea Get the Bomb</u>, Foreign Policy (2021).

¹⁵⁸ Kim Tong-Hyung, <u>North Korea Says It Tested a New Hypersonic Intermediate-Range Missile That's Easier to Hide</u>, Associated Press (2024); Josh Smith, <u>North Korea's First Spy Satellite is 'Alive'</u>, <u>Can Manoeuvre</u>, <u>Expert Says</u>, Reuters (2024); <u>Annual Threat Assessment of the U.S. Intelligence Community</u>. Office of the Director of National Intelligence (2024); <u>North</u> <u>Korea Military Power: A Growing Regional and Global Threat</u>, Defense Intelligence Agency (2021).