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MITRE | Center for Data-Driven Policy

DELIVERING THE FUTURE:
SCIENCE AND TECHNOLOGY, U.S. COMPETITIVENESS, AND INTERNATIONAL COLLABORATION

The accelerated pace of science and technology has reached an inflection point, and our future hinges on multiple emerging technologies simultaneously. The actions we take in the next four years will define American national security and economic prosperity for decades. To compete and succeed, the United States must prioritize investments in a sub-set of the highest-priority technologies, such artificial intelligence (AI), biotech, semiconductors, telecom, and quantum; foster public-private and international collaboration; and mitigate the significant risks in today's geopolitical landscape.

The Case for Action

Humanity's progress through science and technology is astounding, and the United States has been on the forefront of such innovation for decades. In the more recent past, however, China has made enormous advances in scientific research and the development (R&D) of emerging technologies. China has even surpassed the United States in some technologies, many of which have dual-use applications. Their rising power presents enormous risks to U.S. national security and the international order. Sustaining and increasing U.S. competitiveness may be the determining factor in whether we can defend our nation from adversarial attacks, increase the power and resilience of the American economy, and maintain an international order that reflects our values. This will depend on building our domestic base in science and technology (S&T), leveraging the capabilities of allies and partners, mitigating risks with adversarial countries, and using economic statecraft to prevent the Chinese Communist Party (CCP) from gaining strategic advantages. It will also depend on developing an American version of "industrial policy" that capitalizes on our innovation ecosystem and inspires a zeal and patriotism that has characterized our nation during other periods of intense competition, like the Apollo and Manhattan projects.

U.S. Global S&T Leadership

S&T is increasingly global and competitive. On the one hand, since WWII the United States has been the dominant leader in science, technology, and innovation. Eight of the 10 largest tech companies worldwide by market capitalization are American;[1] over half of the top 20 universities are in the United States; and the United States

Recommendations for S&T Competitiveness

Promote American-Style Innovation

Bring Together Government, Industry, and Academia

Leverage Allies and Partners on S&T Priorities

Mitigate the Risks of International Collaboration

Attract, Train, and Retain Top STEM Talent

MITRE's mission-driven teams are dedicated to solving problems for a safer world. Through our public-private partnerships and federally funded R&D centers, we work across government and in partnership with industry to tackle challenges to the safety, stability, and well-being of our nation.

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continues to have the highest levels of R&D expenditures in the world, with the private sector accounting for 75% of the funding.[2] Historically, U.S. primacy has been possible because of the values that have underpinned American R&D for decades, such as freedom of inquiry, integrity, collaboration, openness, and accountability—coupled with an entrepreneurial culture. In addition to the economic benefits, this S&T leadership provided the United States many strategic and military advantages. This has gained additional momentum due to recent industrial policy decisions and large-scale R&D funding, such as the Build Act, Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, and Inflation Reduction Act.

Domestic Challenges

Nevertheless, in today's international S&T landscape, it is increasingly difficult for the United States to maintain its competitive edge. In contrast with the CCP's approach, the strength of the United States is its lack of centralized economic command and control. Free markets drive much of the power of the American economy and create conditions for growth and innovation. However, this decentralization also amplifies the complexities of synchronizing efforts across diverse stakeholders, and U.S. government authorities and funding are spread across numerous departments and agencies.[3]

As a result, our current innovation model falls short in the face of global market competition. The U.S. R&D portfolio faces complex challenges that cross technological stovepipes and struggles to fill the so-called "chasm" in the technology adoption life cycle between basic research and marketable commercial applications. Innovators must navigate an ecosystem fraught with challenges in technology governance and how new technologies interact with broader societal, legal-regulatory, and policy dynamics.[4] In addition, congressional appropriations have not kept pace with the enhanced authorization of funding levels. With S&T increasingly refracted through a security lens, we need to find a way to both foster a vibrant U.S. innovation ecosystem and protect our national security.

International Challenges

International cooperation in scientific research and technology is an increasingly complex endeavor. Countries like China have made a remarkable ascent, in no small part due to its rapid increase in expenditures and exploitation of vulnerabilities in the U.S. ecosystem. For over a decade,

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China has been second to the United States in terms of its gross domestic expenditures on R&D. The resulting rise of China's scientific research has been accompanied by a decline in the relative positions of the United States and other major countries.[5] China's rise has also been the result of widespread theft of intellectual property (IP) and its decision to put most of its resources into leveraging early-stage IP. The CCP's investments included an expansion of its education system, lucrative job offers, and generously funded laboratories that have made it harder for the United States to attract and retain the top talent. In contrast with the role of the U.S. private sector, the CCP's policy of "military-civil fusion" has blurred the lines between "academic" research and dual-use applications. And while China is relatively weaker than the United States in terms of innovation, which President Xi has acknowledged,[6] it has excelled at adopting and industrializing technology, especially to supercharge its military-industrial complex.

China's progress is as impressive as it is troubling. An Australian think tank estimated that China is already leading the United States in 36 of 44 critical technologies[7] and is ahead of the United States and its allies in 19 of the 23 technologies specifically relevant to defense cooperation.[8] Others have assessed the United States maintains only a tenuous lead in some technology areas (e.g., internet platforms, synthetic biology, biopharmaceuticals, quantum computing, and fusion energy) while China has already surged ahead in others (e.g., 5G network components, advanced batteries, and commercial drones), and other sectors are still contested (e.g., core areas of AI, next generation networks, semiconductors, and advanced manufacturing).[9] As part of the CCP's ambitions to be preeminent in basic science, it is also using soft power in an effort that is somewhat equivalent to the Belt and Road Initiative and includes investments in universities and research organizations around the world, and training programs bringing scientists to China.

International Opportunities

Simultaneous with mitigating the risks of China's rise, there are numerous opportunities to promote positive international collaboration. For example, the United States joined with its NATO allies to support the Defense Innovation Accelerator for the North Atlantic (DIANA), which is already accelerating dual-use innovation capacity across the alliance. The United States also joined with Australia and the United Kingdom to create the trilateral security partnership known as AUKUS. Building on long-standing and ongoing bilateral ties, AUKUS is promoting information and technology sharing, and fostering deeper integration of security and defense-related science, technology, industrial bases, and supply chains. On the civilian side, the United States has long-standing participation in large-scale projects that no single country could manage, such as the Large Hadron Collider near Geneva, Switzerland,[10] and the involvement of other countries in U.S.-based projects like the Department of Energy's Deep Underground Neutrino Experiment (DUNE) in Illinois and South Dakota.[11] Beyond these multi-country partnerships, the United States also has bilateral Science and Technology Agreements with many countries.

Recommendations for Delivering the Future

Although U.S. competitiveness has taken positive steps forward recently, significant work remains for the United States to succeed at leveraging our S&T investments to advance our national security and economic interests. MITRE has four recommendations that will advance these priorities and reflect our nation's values, character, and strengths.

1. AMERICAN-STYLE INDUSTRIAL POLICY: ORGANIZE AND MOBILIZE OUR WHOLE-OF-NATION INNOVATION ECOSYSTEM.

The United States will do best if we lean into our own strengths as the world's leading innovation ecosystem. As many have noted, the solution is not to replicate what the CCP is doing. To increase our competitiveness, MITRE recommends the next administration issue an executive order that creates a public-private U.S. S&T Competitiveness Council within the White House that focuses on science, technology, innovation, and competitiveness. MITRE recommends the White House announce its intention to create such a council in the first 30 days and have the council operational within 100 days. The council would:

- Drive policy development and budget alignment and deliver concrete outcomes through the Office of Science and Technology Policy (OSTP), National Security Council (NSC), National Economic Council, Office of Management and Budget, and interagency collaboration.
- Launch strategic and targeted communications campaigns that inspire the nation—with defined outcomes like "Man on the Moon" that were at the heart of the Apollo program.
- Partner with the U.S. private sector—since most U.S. R&D is done by the private sector and the operations of today's largest companies do not end at national borders—plus S&T philanthropies and academia.
- Include representatives from key bipartisan congressional committees and have a dedicated legislative liaison.
- Coordinate intelligence development and sharing on S&T threats.
- Provide institutional continuity—in contrast with frequent turnover at NSC and OSTP—and ensure accountability and data-driven outcomes, not just funding outflows.
- Leverage the President's Council of Advisors on Science and Technology; National Academies of Sciences, Engineering, and Medicine; and S&T associations, such as the American Association for the Advancement of Science, Institute of Electrical and Electronics Engineers, and American Physical Society.
- Bring together the federally funded research and development centers (FFRDCs) to improve coordination within government and in support of public-private collaboration.
- Drive forward and oversee the additional recommendations below.

2. HORIZON STRATEGY: BRING GOVERNMENT, INDUSTRY, AND ACADEMIA IN THE UNITED STATES AND PARTNER NATIONS TOGETHER TO ADDRESS OUR MOST IMPORTANT S&T NEEDS.

A horizon strategy can help the United States simultaneously focus on managing the present while also laying the foundations for mid- and long-term success. Such a strategy for innovation-focused R&D will catalyze a range of new opportunities for global competitiveness. It will identify opportunities to cultivate transactional, technology-specific alliances that benefit the United States while also hampering the CCP. A portfolio approach of investing that includes diffuse research to promote discovery, combined with partner nations making complementary investments in scientific facilities, will help unlock the next wave of advances. There are multiple technologies that are emerging and critical, and MITRE has recommended the United States prioritize investments that address our highest priorities, such as AI, biotech, semiconductors, telecom, and quantum. Our subsequent analyses supporting the National Science Foundation as it developed their "TIP Roadmap" reinforces this recommendation.[12] MITRE recommends the White House take the following steps:

- **Civilian:** Within 90 days, finalize a strategy to increase multi-country partnerships between government, industry, and academia and across different domains and sectors; envision new levels of cooperation to prioritize R&D investment; fix flaws in the innovation paradigm; and apply system-ofsystems thinking to "techno-system" challenges. Such a holistic approach to S&T innovation—focused on interdisciplinary and cross-sector problems of national importance but too complex to be solved by a single entity—can help ensure global leadership in the most critical and competitive industries and technologies.[13] MITRE recommends this include government-to-government engagement to influence multinational companies, startups and venture capital, and academic R&D institutions to align investments. This horizontal connectivity to support vertically aligned objectives can result in a matrix of initiatives across countries and sectors in support of a collective agenda. Instead of establishing a singular body or duplicating existing mechanisms, MITRE recommends using large-scale research projects with international contributions and the safety standards in the auto industry as models of partnerships that simultaneously promote cooperation and competition in sectors.

- **Defense:** Building on lessons learned from AUKUS, incrementally expand AUKUS Pillar II to include key partners countries, such as Japan, New Zealand, and South Korea. MITRE recommends this effort include a detailed assessment of the inventory of options and capabilities and making the existing systems and materiel more interoperable.

3. FRIENDS AND FOES: LEVERAGE THE CAPACITY OF ALLIES AND PARTNERS WHILE ALSO MITIGATING THE RISKS OF OUR RELIANCE ON CHINA.

In today's interconnected world, we need to maximize the benefits of international collaboration for the United States and our allies. At the same time, we need to be clear-sighted about the ways in which our competitors, like the CCP, seek to exploit the U.S. system. MITRE recommends:

- **China risk:** Work with U.S.-based multinational companies to move R&D and engineering groups from China to friendly shores, such as India; coordinate semiconductor investments in global chip companies to shift production broadly to the West, while also ensuring the United States and European Union don't out-subsidy each other to attract such investment; and identify an alternative low-cost solution for Chinese DNA sequencing and synthesis that is essential to biotech. In addition, given the competing agendas on AI and its consequential impacts on the nation and world, MITRE also recommends the United States lead on AI assurance to mitigate risks and assess the security, safety, and efficacy of AI systems.

- **Economic statecraft:** Within 30 days, task the Departments of Commerce, State, and Treasury to increase the use of S&T as a metric in use of sanctions, export controls, Committee on Foreign Investment in the United States (CFIUS) reviews, and outbound investment screening.

- **Research security:** While the United States has taken important steps to improve research security, we continue to fall short in adequately measuring and mitigating domestic risks. In addition, some of our closest partners, with whom we have extensive S&T collaboration, are even farther behind. MITRE recommends the White House within the first 90 days launch an initiative that expands our efforts to increase both international awareness and capacity for addressing the risks to research security by building on our existing Five Eyes partnership.

4. WORKFORCE FOR THE FUTURE: ATTRACT, TRAIN, AND RETAIN THE TOP TALENT IN THE HIGHEST-PRIORITY FIELDS.

For the United States to maintain and regain its competitive advantages in key technologies and execute this vision, we need to partner with the private sector and academia to build on lessons learned and develop the appropriate workforce of the future. To achieve this MITRE recommends:

- **Domestic:** Within 60 days, announce plans to accelerate new models of education so that we can build domestic capacity to meet the ballooning demand for technical and multidisciplinary skills. This includes expanding the National Science Foundation's CyberCorps[14] model into other domains, such as AI. This combination of education and public service would cultivate technical skills and help unify our nation by providing people with the front-line experience of serving their country.
- **Foreign:** The United States won't be able to meet the urgent talent demands with only our domestic workforce. Our success will also depend on attracting the best foreign students to study and stay in the United States, including through proper vetting. There are enormous short-term economic benefits to having foreign students pay for their higher education in the United States. There are also many long-term benefits from retaining them, including for U.S. industries. Training programs, especially focused on the developing world, will build the capacity of our partners and attract scientists and technologists to the United States. MITRE recommends the White House within 30 days announce the creation of a task force focused on bringing and keeping the top talent in the United States, which also prevents them from helping our competitors.

MITRE Resources and Support

Building on 65 years of experience working across government, MITRE is fortifying America's national security and driving advancements in science and technology. As an operator of six FFRDCs,[15] MITRE is stimulating new ways of thinking and action to tackle national and global challenges, in partnership with industry and academia. MITRE Labs[16] inspires breakthroughs in applied science and advanced technology to transform the future of U.S. scientific and economic leadership. We are applying the objectivity and expertise of 4,000+ technical staff and other significant resources to strengthen U.S. competitiveness.

MITRE's "Horizon Strategy" Framework for Science and Technology Policy
https://www.mitre.org/news-insights/publication/horizon-strategy-framework-science-and-technology-policy

- This framework identifies the following priorities: advanced manufacturing, artificial intelligence, biotechnology, climate & energy, cybersecurity, health informatics, microelectronics, quantum information science, and telecommunications.

Partnerships to Accelerate Advancement of Priority S&T
https://www.mitre.org/news-insights/publication/partnerships-accelerate-advancement-priority-st

- This paper identifies four opportunities in a technology's early life cycle and how strategic collaboration at the right point in the evolutionary cycle can significantly accelerate advancement.

AI Assurance Summit
https://www.mitre.org/news-insights/publication/ai-assurance-challenges-maturity-and-paths-forward

- During this summit, MITRE connected AI leaders from multiple federal agencies to identify common practices and capabilities to guarantee the safe, secure, and effective application of AI in the United States.

Public-Private Horizon Scanning
https://www.mitre.org/news-insights/publication/collaborative-horizon-scanning

- Building on a new model for public-private cooperation, MITRE co-hosted a workshop to collect and discuss input from national S&T thought leaders on designing the early steps for collaborative horizon scanning.

About the Center for Data-Driven Policy

The Center for Data-Driven Policy, bolstered by the extensive expertise of MITRE's approximately 10,000 employees, provides impartial, evidence-based, and nonpartisan insights to inform government policy decisions. MITRE, which operates several federally funded research and development centers, is prohibited from lobbying. Furthermore, we do not develop products, have no owners or shareholders, and do not compete with industry. This unique position, combined with MITRE's unwavering commitment to scientific integrity and to work in the public interest, empowers the Center to conduct thorough policy analyses free from political or commercial pressures that could influence our decision-making process, technical findings, or policy recommendations. This ensures our approach and recommendations remain genuinely objective and data-driven.

Connect with us at policy@mitre.org.

Endnotes

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