



NATIONAL STRATEGY
for
CRITICAL AND EMERGING
TECHNOLOGIES

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关键与新兴技术国家战略

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战略关键点一览：

1. 总体战略强调：技术战略与国家战略相统一。
2. 掌握技术话语权并保持领导力。关键技术和新兴技术的世界领导者：技术领导者，技术同行，技术风险管理。
3. 两个关键战略。（1）推进美国国家安全创新基地(NSIB)；（2）保护技术优势。
4. 目前最高优先级的战略为：《国家关键与新兴技术战略》
5. 附件：美国政府 20 个关键与新兴技术列表。

纵观我们的历史，美国在科学技术(S&T)方面的成就和领导地位一直是我们生活方式、繁荣和安全的驱动因素。然而，美国在 S&T 的领导地位面临着来自战略竞争对手越来越多的挑战，这些竞争对手认识到 S&T 的好处，并正在全国范围内组织大量人力和资本资源，在具有长期影响的领域发挥领导作用。

1.1 科技与创新

《国家安全战略》(NSS)提出了促进美国繁荣的愿景，并在一个大国竞争的时代提升美国的影响力。其中强调了那些对经济增长和安全至关重要的新兴技术，在研究、技术、发明和创新(文中统称为科学技术(S&T))。《国家安全战略》还呼吁美国促进和保护美国国家安全创新基地(NSIB)，该基地被定义为美国的知识、能力和人员网络—包括学术界、国家实验室和私营部门—将想法转化为创新，将发现转化为成功的商业产品和公司，并保护和改善美国的生活方式。

1.2 国际竞争

文中称，X 国为了成为科技领域的全球领导者投入大量资源，同时也为了在本世纪中叶发展世界级的军队，正在实施一项战略，将新兴技术转移到军事项目中。而俄罗斯也将发展先进的科学技术(S&T)视为国家安全的优先事项，并以美国的技术为目标，包括其军事和情报计划，通过利用各种合法和非法技术转让机制来进行支持。

与 X 国相比，俄罗斯拥有的资源更少，因此俄罗斯正将其政府主导的 S&T 发展集中在军事和两用技术上，如人工智能等。尽管俄罗斯专注于开发军事应用而不是民用应用，但也认识到了工业研发的重要性。俄罗斯计划通过 XXXX 来建立国防工业基地，从而为未来的军事需求开发所需的创新技术。

1.3 关键与新兴技术清单

将通过推广美国国家安全创新基地来保护技术优势，尤其是在关键与新兴技术（C&ET）领域保持全球领先地位。就本战略而言，C&ET 是指那些被国家安全委员会（NSC）确定和评估为对美国国家安全优势（包括军事、情报和经济优势）至关重要或可能变得至关重要的技术。附录 A 中包含了当前的关键与新兴技术清单（文末可见）。

1.4 高度优先“关键与新兴技术”

而由于关键与新兴技术涵盖的领域广泛，美国将在最优先的技术领域保持明确的领导，并邀请其盟友和伙伴共同发展。其中“关键与新兴技术领域”为高度优先领域，美国将与其盟国和伙伴一道做出贡献。最后，在其余的新兴技术领域，美国将适当的对国家安全风险进行管理。

1.5 与国家战略相统一

美国的关键与新兴技术领导不再主要由美国政府资助，自 1980 年以来，私营部门在研发方面的支出超过了美国政府的资金。然而，美国政府可以创造必要的条件来领导世界范围内的关键与新兴技术。战略竞争对手，如 X 国和俄罗斯正在进行大规模的战略投资，以取得领先地位。因此，美国在某些关键与新兴技术行业的领先地位正在下降。美国将采取有意义的行动来扭转这一趋势。

1.6 整合

美国将通过利用其美国国家安全创新基地（NSIB）和优越的经济体系，在关键与新兴技术方面领先。关键与新兴技术国家战略鼓励整个美国政府团结一致，并提供了一个框架，可以协调多个技术领域。美国不可能在每一个技术领域的所有方面都处于领先地位，而且没有任何一项技术能够确保全球 C&ET 的领导地位。事实上，许多技术突破都发生在两个或更多不同技术的交叉点上。因此，需要一种整体的方法来解决各种应用的技术日益趋同的问题。

关键技术和新兴技术的世界领导者

这一战略概述了美国及其盟国和伙伴将继续在关键与新兴技术（C&ET）方面处于世界领先地位的方式和方法。

（一）领导者

美国将在最优先的技术领域领先，以确保国家安全和经济繁荣。技术领导将需要预测、由于资源有限而确定优先次序、与盟国和合作伙伴的协调、在开发周期的早期进行适当的投资以及随着技术成熟而定期重新评估。

（二）盟友与合作伙伴

随着在最高优先技术领域取得或保持领先地位，美国将与其盟国和伙伴在其他高优先技术领域保持技术对等。美国将与其盟友和合作伙伴一道，在互利、团队合作、安全和均衡投资的基础上推进关键与新兴技术。美国可以与盟友和合作伙伴分享其人才和能力，并从中获益。

（三）风险管理

一些新兴技术正在全球扩散，或者还处于早期研发阶段，无法明确识别其对美国国家安全的影响。在这些情况下，将采用风险管理方法来衡量国家安全影响，为投资提供信息，并监测其发展。在管理风险时，美国政府将首先识别、评估其技术风险并确定其优先级，然后采取协调一致的应对措施来避免、减少、接受或转移风险。

美国及其盟国和合作伙伴将通过两个关键行动，继续在关键与新兴技术领域保持世界领先地位：促进美国国家安全创新基地 (NSIB) 和保护技术优势。

支柱一：推进国家安全创新基地建设 (NSIB)

“美国的思想家、发明家和企业家，在自由市场资本主义的激励下，在大胆想法的驱动下，创造了一个令世界羡慕的创新生态系统，使我们的国家繁荣富强。”——总统唐纳德特朗普，2019年10月

推广美国国家安全创新基地 (NSIB) 需要对其各个方面进行持续、长期的投资，包括：科学、技术、工程和数学教育；先进的技术劳动力；和早期 R&D 的创新型法规；风险资本；政府、学术界和私营部门之间的合作；与盟友和伙伴合作。

优先行动：将考虑或采取以下措施来促进 C&ET 的发展，鼓励州和地方政府

采取类似的行动。（排序不分先后）

- （1）培养世界上最高质量的科学技术劳动力；
- （2）吸引并留住发明家和创新者；
- （3）利用私人资本和专业知识进行建设和创新；
- （4）迅速推动发明和创新；
- （5）减少抑制创新和行业增长的繁琐法规、政策和官僚程序；
- （6）引领反映民主

价值观和利益的全球技术规范、标准和治理模式的发展；（7）支持发展一个强大的 NSIB，包括学术机构，实验室，支持基础设施，风险投资，支持企业和工业；

（8）提高 R&D 在制定美国政府预算中的优先地位；（9）在政府内部开发和采用先进的技术应用，并提高政府作为私营部门客户的可取性；（10）鼓励公私伙伴关系；（11）与志同道合的盟友和伙伴建立牢固而持久的技术伙伴关系，促进民主价值观和原则；（12）与私营部门一起，创造积极的信息，以提高公众对社区和社区教育的接受度。

支柱二：保护技术优势

第二个保持和提高美国在关键及新兴技术领域（C&ET）领导地位的方法是保护在国内以及与盟友和合作伙伴的技术优势。

美国不容忍知识产权盗窃、对开放科学规范的利用或对 C&ET 的经济侵犯。保护美国的技术优势包括加强存在差距的规则，执行协议，以及与志同道合的盟友和伙伴合作，以确保我们的共同原则占上风。保护美国技术优势的另一部分是保卫我们的 NSIB，需要公司、行业、大学和政府机构之间的国内与国际合作。美国还将与盟友和伙伴站在一起，反对对各自国家安全机构的袭击。

优先行动：将考虑或采取以下措施来保护 C&ET 优势（排序不分先后）

（1）确保竞争对手不使用非法手段获取美国知识产权、研究、开发或科技；（2）在技术开发阶段的早期要求安全设计，并与盟友和合作伙伴一起采取类似的行动；（3）通过促进学术机构、实验室和行业的研究安全来保护 R&D 企业的完整性，同时平衡外国研究人员的贡献；（4）确保在出口法律法规以及多边出口制度下，对进出口贸易的适当方面进行充分控制；（5）让盟友和合作伙伴参与制定他们自己的流程，类似于美国外国投资委员会(CFIUS)执行的流程；（6）让私营部门参与进来，从私营部门对成本与收益以及与成本与收益相关的未来战略漏洞的理解中获益；（7）评估全球 S&T 政策、能力和趋势，以及它们可能如何影响或破坏美国的战略和计划；（8）确保安全的供应链，并鼓励盟友和合作伙伴也这样做；（9）向主要利益相关方传达保护技术优势的重要性，并尽可能提供实际帮助。

根据《NSS 协议》制定的《国家关键与新兴技术战略》统一了美国政府与我们的盟友和合作伙伴保持全球关键与新兴技术领导地位的努力。美国将在最高优先级的关键与新兴技术领域发挥领导作用，在高优先级的 C&ET 领域与盟友和合作伙伴共同做出贡献，并管理其他关键与新兴技术领域的技术风险。通过推广 NSIB 和保护技术优势，保持在全球 C&ET 领域的领先地位。

附录：美国政府关键与新兴技术清单

关键技术和新兴技术列表反映了美国政府部门和机构向国家安全委员会工作人员确定的 20 个技术领域，作为其任务的优先领域。该名单将通过由国家安全委员会工作人员协调的机构间进程每年进行审查和更新（技术领域按字母顺序排列）。(1) 高级计算(2) 先进常规武器技术(3) 高级工程材料(4) 先进制造(5) 高级传感(6) 航空发动机技术(7) 农业技术(8) 人工智能(9) 自主系统(10) 生物技术(11) 化学、生物、放射和核(CBRN)减缓技术(12) 通信和网络技术(13) 数据科学与存储(14) 分布式分类技术(15) 能源技术(16) 人机界面(17) 医疗和公共卫生技术(18) 量子信息科学(19) 半导体和微电子学(20) 空间技术

WORLD LEADER OF CRITICAL AND EMERGING TECHNOLOGIES

TECHNOLOGY LEADER

TECHNOLOGY PEER

TECHNOLOGY RISK
MANAGEMENT

PILLAR I PROMOTE THE NATIONAL SECURITY INNOVATION BASE

- Develop the highest-quality science and technology (S&T) workforce in the world
- Attract and retain inventors and innovators
- Leverage private capital and expertise to build and innovate
- Rapidly field inventions and innovations
- Reduce burdensome regulations, policies, and bureaucratic processes that inhibit innovation and industry growth
- Lead the development of worldwide technology norms, standards, and governance models that reflect democratic values and interests
- Support the development of a robust National Security Innovation Base (NSIB), to include academic institutions, laboratories, supporting infrastructure, venture funding, supporting businesses, and industry
- Increase priority of research and development (R&D) in developing United States Government budgets
- Develop and adopt advanced technology applications within government and improve the desirability of the government as a customer of the private sector
- Encourage public-private partnerships
- Build strong and lasting technology partnerships with like-minded allies and partners and promote democratic values and principles
- With the private sector, create positive messaging to increase public acceptance of critical and emerging technologies (C&ET)
- Encourage state and local governments to adopt similar actions

PILLAR II PROTECT TECHNOLOGY ADVANTAGE

- Ensure that competitors do not use illicit means to acquire United States intellectual property, research, development, or technologies
- Require security design early in the technology development stages, and work with allies and partners to take similar action
- Protect the integrity of the R&D enterprise by fostering research security in academic institutions, laboratories, and industry, while balancing the valuable contributions of foreign researchers
- Ensure appropriate aspects of C&ET are adequately controlled under export laws and regulations, as well as multilateral export regimes
- Engage allies and partners to develop their own processes similar to those executed by CFIUS
- Engage with the private sector to benefit from its understanding of C&ET as well as future strategic vulnerabilities related to C&ET
- Assess worldwide S&T policies, capabilities, and trends, and how they are likely to influence, or undermine, American strategies and programs
- Ensure secure supply chains, and encourage allies and partners to do the same
- Message to key stakeholders the importance of protecting technology advantage and offer practical assistance whenever possible



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INTRODUCTION

Throughout our history, American achievements and leadership in science and technology (S&T) have been a driving factor for our way of life, prosperity, and security. However, American leadership in S&T faces growing challenges from strategic competitors, who recognize the benefits of S&T and are organizing massive human and capital resources on a national scale to take the lead in areas with long-term consequences.

The National Security Strategy (NSS) lays out a vision for promoting American prosperity; protecting the American people, the homeland, and the American way of life; preserving peace through strength; and advancing American influence in an era of great power competition. It calls for the United States to lead in research, technology, invention, and innovation, referred to here generally as science and technology (S&T), by prioritizing emerging technologies critical to economic growth and security. The NSS also calls for the United States to promote and protect the United States National Security Innovation Base (NSIB), which it defines as the American network of knowledge, capabilities, and people – including academia, National Laboratories, and the private sector – that turns ideas into innovations, transforms discoveries into successful commercial products and companies, and protects and enhances the American way of life.

Our market-oriented approach will allow us to prevail against state-directed models that produce waste and disincentivize innovation, but we will also protect ourselves from unfair competition and prevent the use of our technology for authoritarian activities.

The People’s Republic of China (PRC) is not only dedicating large amounts of resources in its

pursuit to become the global leader in S&T. It is also targeting sources of United States and allied strength by employing means that include stealing technology, coercing companies to disclose intellectual property, undercutting free and fair markets, failing to provide reciprocal access in research and development (R&D) projects, and promoting authoritarian practices that run counter to democratic values. The Chinese government, in its quest to develop a world-class military by mid-century, is implementing a strategy to divert emerging technologies to military programs, referred to as military-civil fusion (MCF).

Russia views the development of advanced S&T as a national security priority, and is targeting United States technology through the employment of a variety of licit and illicit technology transfer mechanisms to support national-level efforts, including its military and intelligence programs. These actions include using illicit procurement networks, seeking technology transfer through joint ventures with Western companies, and requiring access to source code from technology companies seeking to sell their products in Russia. With fewer resources at its disposal compared to the PRC, Russia is focusing its government-led S&T efforts on military and dual-use technologies, such as artificial intelligence, that

it believes will bring both military and economic advantages. Despite its focus on developing military versus civil applications, Russia recognizes the importance of industrial R&D. Russia plans to develop needed innovative technologies for its future military requirements by enabling its defense industrial base through civil-military integration.

In accordance with the NSS, we will maintain worldwide leadership in critical and emerging technologies (C&ET) by promoting our NSIB and protecting our technological advantage. For the purposes of this strategy, C&ET are defined as those technologies that have been identified and assessed by the National Security Council (NSC) to be critical, or to potentially become critical, to the United States' national security advantage, including military, intelligence, and economic advantages. The current list of C&ET is included in Annex A.

The United States, with its allies and partners who share common open, democratic, and market-oriented values, will continue to lead the world in C&ET. Since C&ET cover a broad range of areas, the United States will maintain clear leadership in the highest priority C&ET areas and invite its allies and partners to join in those efforts. In high-priority C&ET areas, the United States will be a contributing peer with its allies and partners. Finally, in the remaining emerging technology areas, the United States will appropriately manage any risks to national security.

Unified with a National Strategy

The United States Government is unified behind this common National Strategy for C&ET, and will effectively encourage the

private sector to consider and address the national security implications of C&ET. American C&ET leadership is no longer driven mainly by United States Government funding, and C&ET advances are increasingly taking place outside the United States. Private sector spending on R&D has eclipsed United States Government funding since 1980. However, the United States Government can create the necessary conditions for worldwide C&ET leadership. Strategic competitors, such as the PRC and Russia, have adopted deliberate whole-of-government C&ET efforts and are making large and strategic investments to take the lead. As a result, America's lead in certain C&ET sectors is declining. The United States will take meaningful action to reverse this trend.

The United States will proactively lead in C&ET by leveraging its NSIB, and superior economic system. Proactive choices will enable the United States to seize opportunities to shape and optimally benefit from the technological landscape, stay ahead of strategic competitors, and advance democratic values.

The National Strategy for C&ET encourages unity of effort across the United States Government and provides a framework from which deliberate actions will affect multiple technology areas in a coordinated manner. It is not feasible for the United States to lead in all aspects of every technology area, and there is no single technology that will ensure worldwide C&ET leadership. In fact, many technology breakthroughs occur at the intersection of two or more disparate technologies. Therefore, a holistic approach is required to address the growing convergence of technologies for various applications.



WORLD LEADER OF CRITICAL AND EMERGING TECHNOLOGIES

*“America has long led the world
in innovation and technological advancement.
American ingenuity has launched industries, created jobs,
and improved quality of life at home and abroad.”*

PRESIDENT DONALD J. TRUMP | MARCH 2017

This strategy outlines the ways and means by which the United States, with its allies and partners, will continue to be the world leader in C&ET. To accomplish this enduring state, the United States will lead in the highest-priority C&ET areas, be a contributing peer with allies and partners in high-priority areas, and manage risk in the remaining areas.

As the world leader in C&ET, the United States contributes to and benefits from the technology ecosystems of its allies and partners, maintaining United States advantage and upholding a secure, free, and open international order based on democratic values. This coalition will have access to needed C&ET, regardless of where it resides, and will enjoy increased market share, accrue economic benefits, and avoid technological surprise. Cooperation with allies and partners will not only promote a shared technological advantage, it will also prevent strategic competitors from obtaining unfair advantages.

Technology Leader

The United States will lead in the highest-priority technology areas to ensure its national security and economic prosperity. Technology leadership will require forecasting, prioritization due to limited resources, coordination with allies and partners, appropriate investments early in the development cycle, and periodic re-evaluation as technologies mature.

Technology Peer

As leadership is achieved or maintained in the highest-priority technology areas, the United States will remain a technology peer with its allies and partners in other high-priority technology areas. The United States will work with its allies and partners to advance C&ET based on a foundation of mutual benefit, teamwork, security, and proportional investment. The United States can share its talents and capabilities with allies and partners, and mutually benefit from access to the full

breadth of C&ET available within the trusted community.

Technology Risk Management

Some emerging technologies are globally diffuse or are too early in the R&D phase to have clearly identified implications for

United States national security. In those cases, a risk management approach will be applied to gauge national security implications, inform investments, and monitor development. In managing risk, the United States Government will first identify, evaluate, and prioritize its technology risks, followed by a coordinated response to avoid, reduce, accept, or transfer risk.



PILLARS OF SUCCESS

The United States, with its allies and partners, will continue to be the world leader in C&ET by implementing two necessary pillars of success: **promoting the NSIB**, and **protecting our technology advantage**.

These activities are interrelated and together form the essential actions required to maintain

worldwide C&ET leadership. For maximum benefits, opportunities to promote and protect will be considered in every effort. For example, protecting intellectual property encourages innovation investment, demonstrating how protecting technology advantage can indirectly promote technology development.



PILLAR I

PROMOTE THE NATIONAL SECURITY INNOVATION BASE

“American thinkers, inventors, and entrepreneurs, empowered by free market capitalism and driven by bold ideas, have created an ecosystem of innovation that is the envy of the world, making our Nation prosperous and strong.”

PRESIDENT DONALD J. TRUMP | OCTOBER 2019

Promoting the NSIB requires a sustained, long-term investment in all aspects of the NSIB, from science, technology, engineering, and mathematics (STEM) education; an advanced technical workforce; and early-stage R&D to innovation-friendly regulations; venture capital; collaboration between government, academia, and the private sector; and working with allies and partners.

Priority Actions

The following actions will be considered or undertaken to promote C&ET development, and are not listed in any particular order:

Develop the highest-quality S&T workforce in the world.

Attract and retain inventors and innovators.

Leverage private capital and expertise to build and innovate.

Rapidly field inventions and innovations.

Reduce burdensome regulations, policies, and bureaucratic processes that inhibit innovation and industry growth.

Lead the development of worldwide technology norms, standards, and governance models that reflect democratic values and interests.

Support the development of a robust NSIB, to include academic institutions, laboratories, supporting infrastructure, venture funding, supporting businesses, and industry.

Increase priority of R&D in developing United States Government budgets.

Develop and adopt advanced technology applications within government, and improve the desirability of the government as a customer of the private sector.

Encourage public-private partnerships.

Build strong and lasting technology partnerships with like-minded allies and partners, and promote democratic values and principles.

With the private sector, create positive messaging to increase public acceptance of C&ET.

Encourage state and local governments to adopt similar actions.



PILLAR II

PROTECT TECHNOLOGY ADVANTAGE

*“The theft of American prosperity will end.
We’re going to defend our industry and create
a level playing field for the American worker.”*

PRESIDENT DONALD J. TRUMP | MARCH 2017

A second way to maintain and improve American leadership in C&ET is to protect our technology advantage both domestically and in conjunction with like-minded allies and partners.

The United States does not tolerate intellectual property theft, the exploitation of open scientific norms, or economic aggression regarding C&ET. Relationships will be rooted in fairness, reciprocity, and faithful adherence to agreements. Protecting the United States technology advantage includes strengthening rules where gaps exist, enforcing agreements, and working with like-minded allies and partners to ensure our common principles prevail.

Another part of protecting the United States technology advantage is defending our NSIB, which requires domestic and international collaboration between companies, industries, universities, and government agencies. The United States will also stand with allies and partners to oppose attacks on their respective NSIBs.

Priority Actions

The following actions will be considered or undertaken to protect C&ET technology advantage, and are not listed in any particular order:

Ensure that competitors do not use illicit means to acquire United States intellectual property, research, development, or technologies.

Require security design early in the technology development stages, and work with allies and partners to take similar action.

Protect the integrity of the R&D enterprise by fostering research security in academic institutions, laboratories, and industry, while balancing the valuable contributions of foreign researchers.

Ensure appropriate aspects of C&ET are adequately controlled under export laws and regulations, as well as multilateral export regimes.

Engage allies and partners to develop their own processes similar to those executed by the Committee on Foreign Investment in the United States (CFIUS).

Engage with the private sector to benefit from its understanding of C&ET as well as future strategic vulnerabilities related to C&ET.

Assess worldwide S&T policies, capabilities, and trends, and how they are likely to influence, or undermine, American strategies and programs.

Ensure secure supply chains, and encourage allies and partners to do the same.

Message to key stakeholders the importance of protecting technology advantage, and offer practical assistance whenever possible.



CONCLUSION

The National Strategy for C&ET, in accordance with the NSS, unifies the United States Government effort to maintain worldwide C&ET leadership with our allies and partners. The United States will lead in the highest-priority C&ET areas, contribute as a peer with allies and partners in high-priority C&ET areas, and manage technology risk in other C&ET areas. Worldwide C&ET leadership will be maintained by promoting our NSIB and protecting our technology advantage.

ANNEX

UNITED STATES GOVERNMENT CRITICAL AND EMERGING TECHNOLOGIES LIST

The Critical and Emerging Technologies (C&ET) list reflects the 20 technology areas that United States Government Departments and Agencies identified to the National Security Council staff as priorities for their missions. The list will be reviewed and updated annually via the interagency process coordinated by the National Security Council staff. The technology areas are arranged alphabetically.

Advanced Computing

Advanced Conventional Weapons
Technologies

Advanced Engineering Materials

Advanced Manufacturing

Advanced Sensing

Aero-Engine Technologies

Agricultural Technologies

Artificial Intelligence

Autonomous Systems

Biotechnologies

Chemical, Biological, Radiological, and
Nuclear (CBRN) Mitigation Technologies

Communication and Networking
Technologies

Data Science and Storage

Distributed Ledger Technologies

Energy Technologies

Human-Machine Interfaces

Medical and Public Health Technologies

Quantum Information Science

Semiconductors and Microelectronics

Space Technologies