CRITICAL AND EMERGING TECHNOLOGIES LIST UPDATE

A Report by the

FAST TRACK ACTION SUBCOMMITTEE ON CRITICAL AND EMERGING TECHNOLOGIES

of the

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

February 2022

WPR

ID：Interflow-Platform

▼简介：聚焦科技热点分析，洞察行业发展走势，元宇宙、数字化及智能制造领域信息分享的专业平台。上千篇报告供你免费下载，WPR，祝你成功！快点加入我们吧！

About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the Executive Branch coordinates science and technology policy across the diverse entities that make up the Federal research and development enterprise. A primary objective of the NSTC is to ensure that science and technology policy decisions and programs are consistent with the President's stated goals. The NSTC prepares research and development strategies that are coordinated across Federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. More information is available at http://www.whitehouse.gov/ostp/nstc.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of Federal research and development in budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. More information is available at http://www.whitehouse.gov/ostp.

About the Fast Track Action Subcommittee on Critical and Emerging Technologies

The NSTC established this Fast Track Action Subcommittee in 2020 to identify critical and emerging technologies to inform national security-related activities. In support of this work, the Subcommittee coordinated across the NSTC and the National Security Council (NSC) to identify priority critical and emerging technology subfields.

About this Document

This document identifies critical and emerging technologies.

Copyright Information

NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

Chair

Eric Lander, Director, Office of Science and Technology Policy

Executive Director

Kei Koizumi, Acting Executive Director, National Science and Technology Council, Principal Deputy Director for Policy, OSTP

FAST TRACK ACTION SUBCOMMITTEE ON CRITICAL AND EMERGING TECHNOLOGIES

Co-Chairs

Morgan Dwyer, Office of Science and Technology Policy

Lynne Parker, Office of Science and Technology Policy

Sarah Stalker-Lehoux, National Security Council

Members

Department of Agriculture

Department of Commerce

Department of Defense

Department of Energy

Department of Health and Human Services

Department of Homeland Security

Department of the Interior

Department of Justice

Department of State

Department of Transportation

National Aeronautics and Space Administration

National Science Foundation

National Security Agency

National Security Council staff

National Space Council staff

Office of the Director of National Intelligence

Office of Management and Budget

Office of Science and Technology Policy

Table of Contents

Abbreviations and Acronyms iii
Overview 1
Critical and Emerging Technologies List 2
Critical and Emerging Technology Subfields 3

Abbreviations and Acronyms

AI	artificial intelligence
CET	critical and emerging technology(ies)
NSTC	National Science and Technology Council
OSTP	Office of Science and Technology Policy
RF	radio frequency

Overview

Critical and emerging technologies (CETs) are a subset of advanced technologies that are potentially significant to U.S. national security. The 2021 *Interim National Security Strategic Guidance* defines three national security objectives: protect the security of the American people, expand economic prosperity and opportunity, and realize and defend democratic values.[1] This list identifies CETs with the potential to further these objectives and builds on the October 2020 *National Strategy for Critical and Emerging Technologies,* which contains an initial list of priority CETs.[2] This updated document expands upon that original CET list by identifying subfields for each CET with a focus, where possible, on core technologies rather than on technology application areas or performance characteristics. In focusing on core technologies, the CET list does not highlight important crosscutting objectives that underpin the security and efficacy of CETs, such as the responsible development and deployment of cyber-secure and resilient technologies. Furthermore, the list does not call out enabling capabilities, such as accessible, interoperable, and secure data; adequate test and evaluation infrastructure; and a modernized, technically capable workforce. Although not explicitly included in the CET list, such objectives and enabling capabilities are critical to the promotion and protection of all CETs.

Although not a strategy itself, this updated CET list will inform a forthcoming strategy on U.S. technological competitiveness and national security. This list may also inform future efforts to prioritize across CETs and their component subfields; however, *this list should not be interpreted as a priority list for either policy development or funding*. Instead, this list should be used as a resource to: inform future efforts that promote U.S. technological leadership; cooperate with allies and partners to advance and maintain shared technological advantages; develop, design, govern, and use CETs that yield tangible benefits for society and are aligned with democratic values; and develop U.S. Government measures that respond to threats against U.S. security. Departments and agencies may consult this CET list when developing, for example, initiatives to research and develop technologies that support national security missions, compete for international talent, and protect sensitive technology from misappropriation and misuse.

To generate this updated CET list, the Office of Science and Technology Policy (OSTP) facilitated an extensive interagency deliberative process through the National Science and Technology Council (NSTC) and in coordination with the National Security Council (NSC). The responsible NSTC subcommittee included subject matter experts from 18 departments, agencies, and offices in the Executive Office of the President, who, over the course of a year, identified CET subfields that their home organizations determined may be critical to U.S. national security. As such, this updated CET list, which was coordinated through both the NSTC and the NSC, reflects an interagency consensus on updates to the 2020 CETs.

[1] https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf
[2] https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/10/National-Strategy-for-CET.pdf

Critical and Emerging Technologies List

The following critical and emerging technology areas are of particular importance to the national security of the United States:

- Advanced Computing
- Advanced Engineering Materials
- Advanced Gas Turbine Engine Technologies
- Advanced Manufacturing
- Advanced and Networked Sensing and Signature Management
- Advanced Nuclear Energy Technologies
- Artificial Intelligence
- Autonomous Systems and Robotics
- Biotechnologies
- Communication and Networking Technologies
- Directed Energy
- Financial Technologies
- Human-Machine Interfaces
- Hypersonics
- Networked Sensors and Sensing
- Quantum Information Technologies
- Renewable Energy Generation and Storage
- Semiconductors and Microelectronics
- Space Technologies and Systems

Critical and Emerging Technology Subfields

Each identified CET area includes a set of key subfields that describe its scope in more detail.

Advanced Computing

- Supercomputing
- Edge computing
- Cloud computing
- Data storage
- Computing architectures
- Data processing and analysis techniques

Advanced Engineering Materials

- Materials by design and material genomics
- Materials with new properties
- Materials with substantial improvements to existing properties
- Material property characterization and lifecycle assessment

Advanced Gas Turbine Engine Technologies

- Aerospace, maritime, and industrial development and production technologies
- Full-authority digital engine control, hot-section manufacturing, and associated technologies

Advanced Manufacturing

- Additive manufacturing
- Clean, sustainable manufacturing
- Smart manufacturing
- Nanomanufacturing

Advanced and Networked Sensing and Signature Management

- Payloads, sensors, and instruments
- Sensor processing and data fusion
- Adaptive optics
- Remote sensing of the Earth
- Signature management
- Nuclear materials detection and characterization
- Chemical weapons detection and characterization
- Biological weapons detection and characterization
- Emerging pathogens detection and characterization
- Transportation-sector sensing
- Security-sector sensing
- Health-sector sensing
- Energy-sector sensing
- Building-sector sensing
- Environmental-sector sensing

Advanced Nuclear Energy Technologies

- Nuclear energy systems
- Fusion energy
- Space nuclear power and propulsion systems

Artificial Intelligence (AI)

- Machine learning
- Deep learning
- Reinforcement learning
- Sensory perception and recognition
- Next-generation AI
- Planning, reasoning, and decision making
- Safe and/or secure AI

Autonomous Systems and Robotics

- Surfaces
- Air
- Maritime
- Space

Biotechnologies

- Nucleic acid and protein synthesis
- Genome and protein engineering including design tools
- Multi-omics and other biometrology, bioinformatics, predictive modeling, and analytical tools for functional phenotypes
- Engineering of multicellular systems
- Engineering of viral and viral delivery systems
- Biomanufacturing and bioprocessing technologies

Communication and Networking Technologies

- Radio-frequency (RF) and mixed-signal circuits, antennas, filters, and components
- Spectrum management technologies
- Next-generation wireless networks, including 5G and 6G
- Optical links and fiber technologies
- Terrestrial/undersea cables
- Satellite-based communications
- Hardware, firmware, and software
- Communications and network security
- Mesh networks/infrastructure independent communication technologies

Directed Energy

- Lasers
- High-power microwaves
- Particle beams

Financial Technologies

- Distributed ledger technologies
- Digital assets
- Digital payment technologies
- Digital identity infrastructure

Human-Machine Interfaces

- Augmented reality
- Virtual reality
- Brain-computer interfaces
- Human-machine teaming

Hypersonics

- Propulsion
- Aerodynamics and control
- Materials
- Detection, tracking, and characterization
- Defense

Quantum Information Technologies

- Quantum computing
- Materials, isotopes, and fabrication techniques for quantum devices
- Post-quantum cryptography
- Quantum sensing
- Quantum networking

Renewable Energy Generation and Storage

- Renewable generation
- Renewable and sustainable fuels
- Energy storage
- Electric and hybrid engines
- Batteries
- Grid integration technologies
- Energy-efficiency technologies

Semiconductors and Microelectronics

- Design and electronic design automation tools
- Manufacturing process technologies and manufacturing equipment
- Beyond complementary metal-oxide-semiconductor (CMOS) technology
- Heterogeneous integration and advanced packaging
- Specialized/tailored hardware components for artificial intelligence, natural and hostile radiation environments, RF and optical components, high-power devices, and other critical applications

- Novel materials for advanced microelectronics
- Wide-bandgap and ultra-wide-bandgap technologies for power management, distribution, and transmission

Space Technologies and Systems

- On-orbit servicing, assembly, and manufacturing
- Commoditized satellite buses
- Low-cost launch vehicles
- Sensors for local and wide-field imaging
- Space propulsion
- Resilient positioning, navigation, and timing (PNT)
- Cryogenic fluid management
- Entry, descent, and landing