

Critical Technologies / Renewable Energy Generation and Storage

July 2024

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OUSD (R&E) STRATEGIC VISION



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR CRITICAL TECHNOLOGIES

RESEARCH AND ENGINEERING

UNDER SECRETARY OF DEFENSE 3030 DEFENSE PENTAGON WASHINGTON, DC 20301-3030

February 1, 2022

SUBJECT: USD(R&E) Technology Vision for an Era of Competition

The Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E) will spearhead a National Defense Science and Technology strategy for the Department of Defense (DoID), informed by the 2022 National Defense Strategy (NDS) and structured around three strategic pillars: mission focus, foundation building, and succeeding through teamwork. This technology strategy will chart a course for the United States' military to strengthen its technological superiority amidst a global race for technological advantage.

To maintain the United States military's technological advantage, the Department will champion research, science, technology, engineering, and innovation. From the earliest days of this country the role of technology in shaping military concepts and providing for the defense of the nation has been essential. The demands of the present era call for new operational concepts, increasingly joint operations, and quickly fielding emerging science and technology opportunities.

Strategic competitors to the United States have greater access to commercial state-of-theart technologies than ever before and can wield these technologies to be disruptive to America's interests and its national security. The challenges facing our country are both diverse and complex, ranging from sophisticated cyber-attacks to supply chain risks, and from defending Succeed through Teamwork: Maximize our asymmetric advantages by partnering with the larger innovation ecosystem, from industry to universities and to laboratories, allies and partners.

The Department must expand its relationships with the entire technology ecosystem across America and its allies and partners. Innovation has always been a strength of the United States, and the Department will harness that innovation. The Department must focus its developmental resources on unique capabilities needed by the military and quickly adopt the best commercial dual-use technologies. In the era ahead, the Department will diversify partnerships to bring in creative new entrants. Allies and partner nations are an asymmetrical advantage for the United States, and the Department will partner with nations that are aligned with the principles of the United States to jointly develop and deploy technology.

C. Critical Technology Areas

The OUSD(R&E) works closely with the Military Services, Combatant Commands, industry, academia, and other stakeholders to ensure that the Department's science and technology strategy addresses the key national security challenges—from rising seas to a rising China—that the United States faces today and will face in the future.

Three categories of technology areas recognize the more varied and complex environment for investment, development, and application of technology that characterizes the early 21st century. There are 14 critical technology areas vital to maintaining the United States' national security grouped into three categories. While many technologies may cross between these categories, these groupings represent the broad and different approaches that are required to advance technologies crucial to the Department. By focusing efforts and investments into these 14 critical technology areas, the Department will accelerate transitioning key capabilities to these 14 critical technology areas, the Department Area technology strategy

TECHNOLOGY VISION FOR AN ERA OF COMPETITION

breakthroughs to prevent technological surprise. The Department must harness the incredible innovation ecosystem both domestically and globally in order to stay ahead of our competitors.

Biotechnology Biotechnology is an emerging e

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tment will upd its critical technology priorities.

¹ physical properties at small, even atomic, scales. omic clocks, quantum sensors, quantum computing, and ience promises to enable leap-ahead capabilities. e unprecedented computational speeds and help solve the problems. Quantum sensors promise the ability to v in position, navigation, and timing. From more accurate

3



CRITICAL TECHNOLOGY AREAS



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR CRITICAL TECHNOLOGIES

The creation of the Office of the Assistant Secretary of Defense for Critical Technologies was informed by the 2022 and 2019 National Defense Strategies, which initially established the previous modernization priority areas. Expanding on the original priorities, there are now 14 critical technology areas that are vital to maintaining the United States' national security grouped into three categories.





OUR WHY

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR CRITICAL TECHNOLOGIES

66 We exist to maximize the technological advantage of our service men & women to ensure they are never in a fair fight, today and in the future.



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OUR MISSION

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"We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment."

- 2018 National Defense Strategy

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OUR STRATEGY





OUSD(R&E) ORGANIZATIONAL STRUCTURE







ASD(CT) LEADERSHIP



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SUMMARY OF CTAs



	Advanced Computing & Software	Includes: supercomputing, cloud computing, data storage, computing architectures, and data processing Goal: rapidly modernize legacy software systems with resilient, affordable, and assured new software
	Directed Energy	Includes: high-power lasers and high-power microwave technologies Goal: counter current and emerging threats with rapid responses & engagement at the speed of light
	Human-Machine Interfaces	Includes: highly immersive realistic training environments and intuitive interactive human-machine interfaces Goal: capture real-time feedback to enhance warfighter performance, and a common operational picture to geographically distributed operations for rapid mission planning and mission command
	Hypersonics	Includes: cost-effective technologies for our air, land, and sea operational forces Goal: leap ahead of strategic competitors who are pursuing and rapidly fielding advanced hypersonic missiles
	Integrated Network Systems-of-Systems	Includes: an interoperable network that leverages emerging capabilities across the electromagnetic spectrum such as 5G, software defined networking and radios Goal: realize modern info exchange techniques that allow us to better integrate many diverse mission systems and provide fully networked command, control, and communication that is capable, resilient, and secure
	Integrated Sensing & Cyber	Includes: wideband sensors to operate at the intersection of cyber, electronic warfare, radar, and comms Goal: deliver advantage for the joint force in highly contested environments
	Microelectronics	Includes: secure microelectronics sources that leverage state-of-the-art commercial development Goal: produce defense microelectronic solutions that address national economic and security risks
(A)	Renewable Energy Generation & Storage	Includes : more efficient batteries, diversified energy sources Goal : reduce fuel transportation risks, decrease warfighter vulnerability, and deliver new operational capabilities
	Space Technology	Includes : robust and proliferated architecture; novel space technologies Goal : launch resilient cross-domain operations; adaptive and reconfigurable capabilities in space situational awareness, space control, comms path diversity, on-orbit processing, and autonomy
ini,	Trusted AI & Autonomy	Includes : machine learning that trains software models using example data, simulations, or real-world experiences Goal : design autonomy that expands robots' abilities to perform tasks while limiting the need for human interaction



Renewable Energy Generation and Storage



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Renewable Energy Generation and Storage (REGS) includes solar wind, biobased and geothermal technologies, advanced energy storage, electronic engines, and power grid integration. Renewable energy generation and storage promises to decrease warfighter vulnerability and deliver new operational capabilities for the Department of Defense (DoD). From more efficient batteries to diversifying energy sources and reduced fuel transportation risks, renewable energy generation and storage will add resilience and flexibility in a contested logistics environment.





Premises



- Modern military capabilities are predicated on assured access to sufficient and secure supplies of energy. Our homeland is no longer a sanctuary in this regard, and logistics will be contested both within the United States and abroad.
- The DoD needs to develop and field renewable/clean energy capabilities. The REGS strategy outlines the technology advancements that will provide resilient energy to the Joint warfighter. In support of the National Defense Strategy, the DoD is taking steps to increase our resilience and adaptability.
- Unlike some other DoD relevant technology areas, generally the DoD is not leading the research and development of renewable energy technologies. It must therefore leverage the combined research investments within the commercial and academic sectors as well as other federal government agencies. This is particularly true of the Department of Energy (DoE) which makes significant renewable energy technology investments that are often aligned with DoD needs.





Three Main Focus Areas

- REGS for Deployed Operations
- REGS for Fixed Bases
- Reduce fuel/energy required to accomplish the mission





THRUSTS



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• REGS for Deployed Operations

- Lithium Batteries
- Large-Scale Energy Storage
- New Advanced Batteries
- Power Beaming
- Production of Fuel at Forward Locations
- Small Modular Reactors at Deployed Locations

• REGS for Fixed Bases

- Microgrids
- Large-Scale Energy Storage
- Next Gen Photovoltaics
- Renewable Aviation Fuel
- Small Modular Reactors
- Geothermal
- OTEC



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• Reduce fuel/energy required to accomplish the mission

- Aircraft Aerodynamic Modifications to Reduce Drag
- Vehicle Hybridization/Electrification/Hydrogen
- Blended Wing Body / Oblique Flying Wing
- Advanced Air Breathing Engines