



The Disruptive Military Technologies That the Pentagon Is Spending Nearly \$150 Billion On

Description

President Joe Biden's \$886.3 billion fiscal 2024 defense budget request includes \$145 billion for research and development into emerging technologies to create new weapons systems using artificial intelligence (AI), hypersonic munitions, and electromagnetic swarms.

The Department of Defense (DOD) and its subsidiary military branch technology laboratories, working in tandem with universities and high-tech contractors that increasingly include small businesses, have produced such big-ticket splashes as newly deployed directed-energy weapons systems and hypersonic-ballistic sensors.

Among prospective products and systems calling for funding in the FY24 spending request are a "rocket cargo" transport that can move 100 tons of cargo anywhere on Earth within an hour; a counter-swarm electromagnetic weapon that can disable drones and be powered from a wall plug; a rotating detonation engine without moving parts; a "pop-up hide" that can make Marines disappear in plain sight; and a Predictive Vehicle Activity for Identification and Location program that "will bring a novel approach to automated target detection and recognition."

There are also more utilitarian products being tested in the budget, such as a portable fluid analyzer, a ship-to-ship system that converts Morse code into text messages, and an assembly line of bigger, faster, better-armed unmanned aircraft, from micro-drones to the latest unmanned long-endurance tactical reconnaissance aircraft (ULTRA).

All have survived, or must soon traverse, the "Valley of Death."

Unlike notable valleys in U.S. military history—Valley Forge, the Chosin, Khe Sanh, the Korengal—this Valley of Death is not a place on a map, but rather a dreaded moment of realization: when a cutting-edge weapon that will deliver a decisive battlefield advantage can't advance from prototype to production and get onto the battlefield in time.



An operational version of the Active Denial System, a military counter-personnel directed energy weapon that is the equivalent of science fiction's heat ray. (Unlisted USAF personnel/Public domain/ Wikimedia Commons)

The Valley of Death

Integrating new, still-maturing technologies into existing programs and platforms without “radical disruption” to multiyear procurement and acquisitions systems is among the trickiest challenges confronting the military, Pentagon officials said during a two-hour April 13 webinar presented by the National Defense Industrial Association (NDIA).

The DOD's under secretary of defense for research and engineering, Heidi Shyu, and the DOD's Defense Advanced Research Projects Agency (DARPA) director, Stefanie Tompkins, noted that the proposed \$145 billion research, development, test, and evaluation (RDT&E) budget is up 12 percent from this year, with the Air Force receiving one-third of the requested outlay.

Shyu said the Science and Technology component of the RDT&E budget request is \$17.8 billion, up 8.3 percent over this year's \$16.5 billion budget.

The annually updated National Defense Science & Technology Strategy is on Secretary of Defense Lloyd Austin's desk, she said.

Shyu said the strategy will focus on the joint mission; creation and deployment of capabilities at speed and scale; establishment of an enduring advantage in talent, infrastructure, research, and collaboration; directed energy weapons; and hypersonic-ballistic sensors.

Technology leaders for three military branches—Army Deputy Assistant Secretary for Research & Technology William Nelson, Naval Research Chief Rear Adm. Lorin Selby, and Air Force Research Laboratory Commander Maj. Gen. Heather Pringle—outlined cooperative ventures with industry and workforce development plans, especially in currying bids and participation in projects by small businesses.

The \$886.3 billion FY24 defense request includes \$842 billion for the Pentagon with emphasis on the “growing multi-domain threat posed by the People’s Republic of China (PRC),” which the DOD has again named the nation’s most pressing “pacing challenge.”

March and April is usually when DOD and military command officers testify before congressional panels about their spending requests during the annual budget cycle leading up to Oct. 1, the official start of the federal fiscal year.

All five of the panelists at the NDIA webinar have been making the rounds on Capitol Hill to meet with congressional bean counters to discuss funding for everything from new whiz-bang weapons, such as fusion-based target recognition systems, to such relatively mundane innovations as snow tires for Humbles, since February.

But on April 13 before the NDIA, a Washington-based nonprofit that represents 1,800 corporations and nearly 60,000 individuals working in the defense manufacturing industry, it was all about the Valley of Death.



The USS Ponce conducts an operational demonstration of the Laser Weapon System while deployed to the Arabian Gulf. (U.S. Navy photo by John F. Williams/Released)

‘Moats of Despair’

Delivering new technologies developed in the commercial sector under DOD contract into the field in a seamless transition, especially when so many weapons systems are interrelated, is a daunting challenge, the officials said.

In fact, in June 2022, Deputy Secretary of Defense Kathleen Hicks called transition discord “one of our biggest problems—the so-called ‘Valley of Death,’ scaling up to full-scale production and fielding” new weapons systems.

Selby said there isn’t just one Valley of Death, but at least three, which he described as “moats of despair.”

The first valley or “moat” is the stage at which the first identified prototype is manufactured and tested, and it doesn’t pan out or it turns out not to have been properly built and tested, he said.

The next is moving a product from prototype to production, he said, which is when other factors come into play, such as costs and manufacturing capabilities, which can make further development unfeasible. “This is a deep valley,” where many projects go to die, he said.

The final one is “getting that production to scale,” Selby said.

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A U.S. Predator unmanned drone armed with a missile stands on the tarmac of Kandahar military airport in Afghanistan on June 13, 2010. (REUTERS/Massoud Hossaini/File Photo)

Incentivizing and Integrating

Shyu said that among innovations the DOD is developing to remedy transition lag is a Rapid Defense Experimentation Reserve, “a collaboration between the military services, combatant commands, industry and coalition partners with the aim of discovering new and innovative war-fighting capabilities.”

Nelson said the Army’s 35 different labs and tech centers nationwide have several programs for “incentivizing Army integrators,” including an SBIR (Small Business Innovation Research) Catalyst designed to get projects across the valleys.

The program matches SBIR funds a vendor may be eligible for with acquisition funds. This allows companies to qualify for up to \$15 million for prototype development, maturation, risk reduction, and demonstration, he said.

Nelson said vendors for as many as 40 to 50 projects could benefit from the program, but the Army is testing it with six awards in the FY24 budget request.

“You’ve got this widget you’ve developed,” he said. “Now it goes across this valley and it becomes a

program.”

In addition to leading the Air Force Research Laboratory as its chief technology officer, Pringle serves in the same capacity for the newly created Space Force.

Among successes using this streamlined approach is the Skyborg project, part of the Air Force’s Vanguard program, which develops unmanned combat aerial vehicles to accompany manned fighters. Four companies were awarded contracts in 2020 to build hundreds of them.

“Nothing could be a more vivid example of crossing the ‘Valley of Death’ than this one,” Pringle said.

Tompkins said DARPA’s role is different from the other military labs’ and that it is “structured to always adjust and readjust” to technological developments and threats.

“Status quo is a losing strategy,” she said of the 250-person operation. DARPA seeks “ideas that could result in new, game-changing technologies for U.S. national security.”

Tompkins said herding investment dollars to get across those valleys is why DARPA is expanding its Embedded Entrepreneurship Initiative (EEI).

“[The initiative is designed to] facilitate collaboration between entrepreneurs and DARPA teams to speed up the production of new innovations,” she said. “The EEI has supported 30 companies and is in the process of expanding to fund 150 research teams.”

This has come into play in advanced microelectronics manufacturing where new products are installed in existing systems that were not designed to interact, Tompkins said.

Transition is also emphasized in DARPA’s AI Forward initiative, which, she said, is “focusing on what happens next in the world of AI.”

The key focus of DARPA’s AI research is defending against hypersonic missiles flying at five times the speed of sound, Tompkins said.

There is no defense yet for these missiles, she said, but she said that she believes that DARPA is on the cusp of, at least in theory, developing one with “third-wave” AI.

The first wave of AI was basically decision trees that work like programs such as TurboTax. The second wave is statistically driven big data machine learning (ML), although Tompkins said statistics-driven AI-ML programs aren’t always best suited for national defense applications.

“The third wave will be the fusion of the first two,” she said, with the third wave in hypersonic missile defense systems being “how to use AI and ML to autonomously fuse, tip, and cue directly from sensor to shooter.”

By John Haughey

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