DARPA

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*This article is about the US military research agency. For other uses, see DARPA (disambiguation).*

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| **Defense Advanced Research Projects Agency** | |
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| **Agency overview** | |
| **Formed** | February 7, 1958; 59 years ago(as ARPA) |
| **Headquarters** | Arlington, Virginia, U.S. |
| **Employees** | 240 |
| **Annual budget** | US $2.97 billion |
| **Agency executive** | * Dr. Steven Walker, Acting Director |
| **Parent agency** | U.S. Department of Defense |
| **Website** | www.darpa.mil |
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DARPA's former headquarters in the Virginia Square neighborhood of Arlington. This agency recently moved to 675 North Randolph Street, near the Ballston Common Mall.

The **Defense Advanced Research Projects Agency** (**DARPA**) is an agency of the U.S. Department of Defense responsible for the development of emerging technologies for use by the military.

Originally known as the **Advanced Research Projects Agency** (**ARPA**), the agency was created in February 1958 by President Dwight D. Eisenhower in response to the Soviet launching of Sputnik 1 in 1957. Since its inception, the agency’s mission is ensuring that the United States avoids further technological surprise. By collaborating with academic, industry, and government partners, DARPA formulates and executes research and development projects to expand the frontiers of technology and science, often beyond immediate U.S. military requirements.

DARPA-funded projects have provided significant technologies that influenced many non-military fields, such as computer networking and the basis for the modern Internet, and graphical user interfaces in information technology.

DARPA is independent from other military research and development and reports directly to senior Department of Defense management. DARPA has about 240 employees, of whom approximately 15 are in management, and close to 140 are technical staff.

The name of the organization changed several times from its founding name ARPA: DARPA (March 1972), ARPA (February 1993), and DARPA (March 1996).

Mission

Currently, DARPA's mission statement is “to make pivotal investments in breakthrough technologies for national security.”

History



DARPA achievements for the past 50 years

**Early history**

The creation of the Advanced Research Projects Agency (ARPA) was authorized by President Dwight D. Eisenhower in 1958 for the purpose of forming and executing research and development projects to expand the frontiers of technology and science, and able to reach far beyond immediate military requirements, the two relevant acts being the Supplemental Military Construction Authorization (Air Force) (Public Law 85-325) and Department of Defense Directive 5105.15, in February 1958. Its creation was directly attributed to the launching of Sputnik and to U.S. realization that the Soviet Union had developed the capacity to rapidly exploit military technology. Initial funding of ARPA was $520 million. ARPA's first director, Roy Johnson, left a $160,000 management job at General Electric for an $18,000 job at ARPA. Herbert York from Lawrence Livermore National Laboratory was hired as his scientific assistant.

Johnson and York were both keen on space projects, but when NASA was established later in 1958 all space projects and most of ARPA's funding were transferred to it. Johnson resigned and ARPA was repurposed to do "high-risk," "high-gain," "far out" basic research, a posture that was enthusiastically embraced by the nation's scientists and research universities. ARPA's second director was Brigadier General Austin W. Betts, who resigned in early 1961. He was succeeded by Jack Ruina who served until 1963. Ruina, the first scientist to administer ARPA, managed to raise its budget to $250 million. It was Ruina who hired J. C. R. Licklider as the first administrator of the Information Processing Techniques Office, which played a vital role in creation of ARPANET, the basis for the future Internet.

Additionally, the political and defense communities recognized the need for a high-level Department of Defense organization to formulate and execute R&D projects that would expand the frontiers of technology beyond the immediate and specific requirements of the Military Services and their laboratories. In pursuit of this mission, DARPA has developed and transferred technology programs encompassing a wide range of scientific disciplines that address the full spectrum of national security needs.

From 1958 to 1965, ARPA's emphasis centered on major national issues, including space, ballistic missile defense, and nuclear test detection. During 1960, all of its civilian space programs were transferred to the National Aeronautics and Space Administration (NASA) and the military space programs to the individual Services.

This allowed ARPA to concentrate its efforts on the Project Defender (defense against ballistic missiles), Project Vela (nuclear test detection), and Project AGILE (counterinsurgency R&D) Programs, and to begin work on computer processing, behavioral sciences, and materials sciences. The DEFENDER and AGILE Programs formed the foundation of DARPA sensor, surveillance, and directed energy R&D, particularly in the study of radar, infrared sensing, and x-ray/gamma ray detection.

ARPA at this point (1959) played an early role in Transit (also called NavSat) a predecessor to the Global Positioning System (GPS). "Fast-forward to 1959 when a joint effort between DARPA and the Johns Hopkins Applied Physics Laboratory began to fine-tune the early explorers’ discoveries. TRANSIT, sponsored by the Navy and developed under the leadership of Dr. Richard Kirschner at Johns Hopkins, was the first satellite positioning system."

During the late 1960s, with the transfer of these mature programs to the Services, ARPA redefined its role and concentrated on a diverse set of relatively small, essentially exploratory research programs. The agency was renamed the Defense Advanced Research Projects Agency (DARPA) in 1972, and during the early 1970s, it emphasized direct energy programs, information processing, and tactical technologies.

Concerning information processing, DARPA made great progress, initially through its support of the development of time-sharing (all modern operating systems rely on concepts invented for the Multics system, developed by a cooperation among Bell Labs, General Electric and MIT, which DARPA supported by funding Project MAC at MIT with an initial two-million-dollar grant).

DARPA supported the evolution of the ARPANET (the first wide-area packet switching network), Packet Radio Network, Packet Satellite Network and ultimately, the Internet and research in the artificial intelligence fields of speech recognition and signal processing, including parts of Shakey the robot. DARPA also funded the development of the Douglas Engelbart's NLS computer system and The Mother of All Demos; and the Aspen Movie Map, which was probably the first hypermedia system and an important precursor of virtual reality.

**Later history**

The Mansfield Amendment of 1973 expressly limited appropriations for defense research (through ARPA/DARPA) only to projects with direct military application. Somecontend that the amendment devastated American science, since ARPA/DARPA was a major funding source for basic science projects of the time; the National Science Foundation never made up the difference as expected.

The resulting "brain drain" is also credited with boosting the development of the fledgling personal computer industry. Some young computer scientists left the universities to startups and private research laboratories such as Xerox PARC.

Between 1976 and 1981, DARPA's major projects were dominated by air, land, sea, and space technology, tactical armor and anti-armor programs, infrared sensing for space-based surveillance, high-energy laser technology for space-based missile defense, antisubmarine warfare, advanced cruise missiles, advanced aircraft, and defense applications of advanced computing. These large-scale technological program demonstrations were joined by integrated circuit research, which resulted in sub micrometer electronic technology and electron devices that evolved into the Very-Large-Scale Integration (VLSI) Program and the Congressionally-mandated charged particle beam program.

Many of the successful programs were transitioned to the Services, such as the foundation technologies in automatic target recognition, space based sensing, propulsion, and materials that were transferred to the Strategic Defense Initiative Organization (SDIO), later known as the Ballistic Missile Defense Organization (BMDO), now titled the Missile Defense Agency (MDA).

**Recent history**

During the 1980s, the attention of the Agency was centered on information processing and aircraft-related programs, including the National Aerospace Plane (NASP) or Hypersonic Research Program. The Strategic Computing Program enabled DARPA to exploit advanced processing and networking technologies and to rebuild and strengthen relationships with universities after the Vietnam War. In addition, DARPA began to pursue new concepts for small, lightweight satellites (LIGHTSAT) and directed new programs regarding defense manufacturing, submarine technology, and armor/anti-armor.

On October 28, 2009 the agency broke ground on a new facility in Arlington, Virginia a few miles from the Pentagon.

In fall 2011, DARPA hosted the 100-Year Starship Symposium with the aim of getting the public to start thinking seriously about interstellar travel.

On June 5, 2016, NASA and DARPA announced that it planned to build new X-planes with NASA's plan setting to create a whole series of X planes over the next 10 years.

In July 2016, it was announced that DARPA would bring a group of top-notch computer security experts to search for security vulnerabilities and create a fix that patches those vulnerabilities and it is called the Cyber Grand Challenge (CGC).

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| **DARPA History** |
| |  | | --- | |  | | The formative years (1958–1975) |  |  | | --- | |  | | The Cold War era (1975–1989) |  |  | | --- | |  | | The Post-Soviet years (1989–present) | |

Organization

**Current program offices**

DARPA has six technical offices that manage the agency's research portfolio, and two additional support offices that manage special projects and transition efforts. All offices report to the DARPA director:

* The Adaptive Execution Office (AEO) is one of two new DARPA offices created in 2009 by the DARPA Director, Regina Dugan. The office's four project areas include technology transition, assessment, rapid productivity and adaptive systems. AEO provides the agency with robust connections to the warfighter community and assists the agency with the planning and execution of technology demonstrations and field trials to promote adoption by the warfighter, accelerating the transition of new technologies into DoD capabilities.
* The Defense Sciences Office (DSO) vigorously pursues the most promising technologies within a broad spectrum of the science and engineering research communities and develops those technologies into important, radically new military capabilities. DSO identifies and pursues high-risk, high-payoff fundamental research initiatives across a broad spectrum of science and engineering disciplines – sometimes reshaping existing fields or creating entirely new disciplines – and transforms these initiatives into radically new, game-changing technologies for U.S. national security.
* The Information Innovation Office (I2O) aims to ensure U.S. technological superiority in all areas where information can provide a decisive military advantage. Some of the program managers in I2O are Wade Shen (as of December 2014), Stuart Wagner (as of September 2014), Steve Jameson (as of August 2014), Angelos Keromytis (as of July 2014), and David Doermann (as of April 2014). John Launchbury is currently the office director.
* The Microsystems Technology Office (MTO) mission focuses on the heterogeneous microchip-scale integration of electronics, photonics, and microelectromechanical systems (MEMS). Their high risk/high payoff technology is aimed at solving the national level problems of protection from biological, chemical and information attack and to provide operational dominance for mobile distributed command and control, combined manned/unmanned warfare, and dynamic, adaptive military planning and execution.
* The Strategic Technology Office (STO) mission is to focus on technologies that have a global theater-wide impact and that involve multiple Services.
* The Tactical Technology Office (TTO) engages in high-risk, high-payoff advanced military research, emphasizing the "system" and "subsystem" approach to the development of aeronautic, space, and land systems as well as embedded processors and control systems.
* The Biological Technologies Office (BTO) fosters, demonstrates, and transitions breakthrough fundamental research, discoveries, and applications that integrate biology, engineering, and computer science for national security. Created in April 2014 by then director Arati Prabhakar, taking programs from the MTO and DSO divisions.

**Former offices**

* Information Awareness Office: 2002–2003
* The Advanced Technology Office (ATO) researched, demonstrated, and developed high payoff projects in maritime, communications, special operations, command and control, and information assurance and survivability mission areas.
* The Special Projects Office (SPO) researched, developed, demonstrated, and transitioned technologies focused on addressing present and emerging national challenges. SPO investments ranged from the development of enabling technologies to the demonstration of large prototype systems. SPO developed technologies to counter the emerging threat of underground facilities used for purposes ranging from command-and-control, to weapons storage and staging, to the manufacture of weapons of mass destruction. SPO developed significantly more cost-effective ways to counter proliferated, inexpensive cruise missiles, UAVs, and other platforms used for weapon delivery, jamming, and surveillance. SPO invested in novel space technologies across the spectrum of space control applications including rapid access, space situational awareness, counterspace, and persistent tactical grade sensing approaches including extremely large space apertures and structures.
* The Information Systems Office (ISO) in the 1990s developed system applications of advanced information technologies. It was a predecessor to the Information Exploitation Office.

A 1991 reorganization created several offices which existed throughout the early 1990s:

* The Electronic Systems Technology Office combined areas of the Defense Sciences Office and the Defense Manufacturing Office. This new office will focus on the boundary between general-purpose computers and the physical world, such as sensors, displays and the first few layers of specialized signal-processing that couple these modules to standard computer interfaces.
* The Computing Systems Technology Office combined functions of the old Information Sciences and Tactical Technology office. The office "will work scalable parallel and distributed heterogeneous computing systems technologies," DoD said.
* The Software and Intelligent Systems Technology Office and the Computing Systems office will have responsibility associated with the Presidential High-Performance Computing Initiative. The Software office will also be responsible for "software systems technology, machine intelligence and software engineering."
* The Land Systems Office was created to develop advanced land vehicle and anti-armor systems, once the domain of the Tactical Technology Office
* The Undersea Warfare Office combined areas of the Advanced Vehicle Systems and Tactical Technology offices to develop and demonstrate submarine stealth and counter stealth and automation.

Reorganization in 2010 merged two offices:

* The Transformational Convergence Technology Office (TCTO) mission was to advance new crosscutting capabilities derived from a broad range of emerging technological and social trends, particularly in areas related to computing and computing-reliant subareas of the life sciences, social sciences, manufacturing, and commerce. The TCTO was folded into the I2O in 2010.
* The Information Processing Techniques Office (IPTO) focused on inventing the networking, computing, and software technologies vital to ensuring DOD military superiority. The IPTO was combined with TCTO in 2010 to form the I2O.

Projects

A list of DARPA's active and archived projects is available on the agency's website. Because of the agency's fast pace, programs constantly start and stop based on the needs of the U.S. government.

**Active projects**

* Aerial Reconfigurable Embedded System (ARES, formerly TX): Cargo carrying UAV.
* ACTUV: A project to build an unmanned Anti-submarine warfare vessel.
* Air Dominance Initiative: Developmental technologies to be used in sixth-generation jet fighters.
* Big Mechanism: Cancer research.
* BlockADE: Rapidly constructed barrier.
* Boeing X-37
* Captive Air Amphibious Transporter
* Clean-Slate Design of Resilient, Adaptive, Secure Hosts (CRASH), a TCTO initiative
* Cognitive Technology Threat Warning System
* Collaborative Operations in Denied Environment (CODE): Modular software architecture for UAVs to pass information to each other in contested environments to identify and engage targets with limited operator direction.
* Combat Zones That See: "track everything that moves" in a city by linking up a massive network of surveillance cameras
* Computational Weapon Optic (CWO): Computer rifle scope that combines various features into one optic.
* DARPA XG: technology for Dynamic Spectrum Access for assured military communications
* Experimental Spaceplane 1 (XS-1): first stage of a reusable space transport
* Gremlins: Air-launched and recoverable UAVs with distributed capabilities to provide low-cost flexibility over expensive multirole platforms.
* Ground X-Vehicle Technology
* Force Application and Launch from Continental United States (FALCON): a research effort within TTO to develop a small satellite launch vehicle. This vehicle is under development by Air Launch LLC.
* Fast Lightweight Autonomy: Software algorithms that enable small UAVs to fly fast in cluttered environments without GPS or external communications.
* High Energy Liquid Laser Area Defense System
* High Productivity Computing Systems
* Hydra: Undersea network of mobile unmanned sensors.
* Integrated Sensor is Structure
* Long Range Anti-Ship Missile
* MEMS Exchange: Microelectromechanical systems (MEMS) Implementation Environment
* Near Zero Power RF and Sensor Operations (N-ZERO): Reducing or eliminating the standby power unattended ground sensors consume.
* Persistent Close Air Support
* Phoenix: A satellite project with the aim to recycle retired satellite parts into new on-orbit assets. System launches no earlier than 2016 or 2017. Satlet tests in low Earth orbit may occur as soon as 2015.
* Protein Design: Processes
* Remote-controlled insects
* Safe Genes: a synthetic biology project to program "undo" sequences into gene editing programs
* Satellite Remote Listening System: a satellite mounted system that can eavesdrop on a targeted area on the surface of the planet in coordination with satellite cameras. This project is in its infant stage.
* System of Systems Integration Technology and Experimentation (SoSITE): Combinations of aircraft, weapons, sensors, and mission systems that distribute air warfare capabilities across a large number of interoperable manned and unmanned platforms.
* Squad X Core Technologies (SXCT): Digitized, integrated technologies that improve infantry squads' awareness, precision, and influence.
* SyNAPSE: Systems of Neuromorphic Adaptive Plastic Scalable Electronics
* SIGMA: A network of radiological detection devices the size of smart phones that can detect small amounts of radioactive materials. The devices are paired with larger detector devices along major roads and bridges.
* Tactical Boost Glide (TBG): Air-launched hypersonic boost glide missile under development.
* Tactically Exploited Reconnaissance Node: Ship-based long-range ISR UAV.
* UAVForge
* Upward Falling Payloads: Payloads stored on the ocean floor that can be activated and retrieved when needed.
* ULTRA-Vis (Urban Leader Tactical Response, Awareness and Visualization): Heads-up display for individual soldiers.
* VTOL X-Plane
* Warrior Web: Soft exosuit to alleviate musculoskeletal stress on soldiers when carrying heavy loads.
* XDATA: Processing and analyzing vast amounts of information.
* Neural implants for soldiers.
* AGM-158C LRASM: Anti-ship cruise missile.

**Past or Transitioned Projects**

* 4MM (4-minute mile): Wearable jetpack to enable soldiers to run at increased speed.
* Adaptive Vehicle Make: Revolutionary approaches to the design, verification, and manufacturing of complex defense systems and vehicles.
* ArcLight: Ship-based weapon system capable of striking targets nearly anywhere on the globe, based on the Standard Missile 3.
* ARPANET, earliest predecessor of the Internet
* ASTOVL, precursor of the Joint Strike Fighter Program
* The Aspen Movie Map allowed one to virtually tour the streets of Aspen, Colorado. Developed in 1978, it is the earliest predecessor to products like Google Street View.
* Atlas: A humanoid robot.
* Battlefield Illusion
* BigDog/Legged Squad Support System: legged robots.
* The Boeing X-45 unmanned combat air vehicle refers to a mid-2000s concept demonstrator for autonomous military aircraft.
* Boomerang (mobile shooter detection system): an acoustic gunfire locator developed by BBN Technologies for detecting snipers on military combat vehicles.
* CALO or "Cognitive Assistant that Learns and Organizes": software
* CPOF: the command post of the future—networked information system for Command control.
* DAML
* ALASA: (Airborne Launch Assist Space Access): A rocket capable of launching a 100-pound satellite into low Earth orbit for less than $1 million.
* FALCON
* DARPA Grand Challenge: driverless car competition
* DARPA Network Challenge
* DARPA Shredder Challenge 2011 – Reconstruction of shredded documents
* DARPA Silent Talk: A planned program attempting to identify EEG patterns for words and transmit these for covert communications.
* DARPA Spectrum Challenge
* DEFENDER
* EATR
* EXACTO: Sniper rifle firing guided smart bullets.
* High Performance Knowledge Bases
* HISSS
* Human Universal Load Carrier: battery-powered human exoskeleton
* Hypersonic Research Program
* Luke Arm, a DEKA creation produced under the Revolutionizing Prosthetics program.
* MAHEM: Molten penetrating munition
* Mesh Worm: an earthworm-like robot.
* Mind's Eye: A visual intelligence system capable of detecting and analyzing activity from video feeds.
* MOSIS
* MQ-1 Predator
* Multics
* Next Generation Tactical Wearable Night Vision: Smaller and lighter sunglass-sized night vision devices that can switch between different viewing bands.
* NLS/Augment: the origin of the canonical contemporary computer user interface
* Northrop Grumman Switchblade: an unmanned oblique-wing flying aircraft for high speed, long range and long endurance flight
* One Shot: Sniper scope that automatically measures crosswind and range to ensure accuracy in field conditions.
* Onion routing, a technique developed in the mid-1990s and later employed by Tor to anonymize communications over a computer network.
* Passive radar
* Policy Analysis Market
* POSSE
* Project AGILE, a Vietnam War-era investigation into methods of remote, asymmetric warfare for use in conflicts with Communist insurgents.
* Project MAC
* Proto 2: a thought-controlled prosthetic arm
* Rapid Knowledge Formation
* Sea Shadow
* SIMNET: Wide area network with vehicle simulators and displays for real-time distributed combat simulation: tanks, helicopters and airplanes in a virtual battlefield.
* DARPA Silent Talk: A planned program attempting to identify EEG patterns for words and transmit these for covert communications.
* System F6—*Future, Fast, Flexible, Fractionated Free-flying Spacecraft United by Information Exchange*—technology demonstrator: a 2006–2012
* I3 (Intelligent Integration of Information), supported the Digital Library research effort through NSF
* Strategic Computing Program
* Synthetic Aperture Ladar for Tactical Applications (SALTI)
* XOS: powered military exoskeletonUS$226 million technology development program. Cancelled in 2013 before the notionally planned 2015 launch date.
* SURAN (1983–87)
* Project Vela (1963)
* Vulture: Long endurance, high-altitude unmanned aerial vehicle VLSI Project - Its offspring include BSD Unix, the RISC processor concept, many CAD tools still in use today.
* Wolfpack

Notable fiction

DARPA is well known as a high-tech government agency, and as such has many appearances in popular fiction. Some realistic references to DARPA in fiction are as "ARPA" in *Tom Swift and the Visitor from Planet X*(DARPA consults on a technical threat), in episodes of television program *The West Wing* (the ARPA-DARPA distinction), the television program *Numb3rs* (DARPA research into creating the first self-aware computer), and in the motion picture *Executive Decision* (use of a one-of-a-kind experimental prototype in an emergency).

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