DARPA DEMOS

WAIT WHAT
A FUTURE TECHNOLOGY FORUM
DARPA

WHAT'S IN MY NETWORK?

When it comes to benefiting from information, trust is a must. Today, however, code, text, images and other forms of data can easily be manipulated. DARPA is developing technologies to ensure the integrity of the data upon which critical decisions are made. These efforts include formal methods for embedded operating systems that are unhackable for specified security properties; automated cyber defense capabilities that respond to attacks so rapidly and effectively as to make attackers consider other lines of work; and tools for comprehensive awareness and understanding of the abstract information systems environment in real time.

At the same time, the bottleneck to wise decision making is not a lack of data but a lack of capacity to identify and understand the most important data. DARPA is developing novel approaches to derive insights from massive datasets and to map behavior patterns at scale; advanced search technologies for discovery, organization and presentation of domain-specific content; and privacy-preserving technologies that enable systems in which private data may be used for its intended purpose and no other.

Featured Projects:

Brandeis
Cyber Grand Challenge (CGC)
High-Assurance Cyber Military Systems (HACMS)
Memex
Plan X
Vanishing Programmable Resources (VAPR)
XDATA

ACROSS THE SPECTRUM

The electromagnetic spectrum functions as the eyes, ears, and voice of modern society. As the spectrum grows more crowded and as technologies from software-defined radios to advanced cameras become commonplace, new opportunities for innovation abound. In the visible and infrared, new advances are creating representations of the world beyond human perception. In the radio frequency domain, we're learning how to thrive in chaos as multiple parties negotiate spectrum use on the fly. And in the territory between these RF and optical domains, promising new devices are starting to emerge that operate in this previously unattainable portion of the spectrum.

Featured Projects:

100 Gb/s RF Backbone (100G)
Advanced RF Mapping (RadioMap)
Advanced Wide FOV Architectures for Image Reconstruction and Exploitation (AWARE)
Cognitive Radio Low-Energy Signal Analysis Sensor ICs (CLASIC)
Diverse Accessible Heterogeneous Integration (DAHI)
Dynamically Adapting RF Technologies (DART)
Fiber Laser Array System High energy laser (FLASH)
Intrachip/Interchip Enhanced Cooling (ICECool)
Power Efficiency Revolution for Embedded Computing Technologies (PERFECT)
Spectrum Challenge
THz Electronics

WHERE, WHEN?

Knowing exactly where you are, how to get from there to where you're going, and how long it will take have become everyday expectations in modern America and are essential for every military mission. Our dependence on the Global Positioning System that makes all this possible is so great that it is becoming an economic and security vulnerability. DARPA is working to break our addiction to GPS by establishing new and better navigational and timing technologies, driving new microelectromechanical systems (MEMS), harnessing the physics of cold atoms, and establishing new fix systems.

Featured Projects:

Adaptable Navigation Systems (ANS)
MEMS Revolution
Program in Ultrafast Laser Science and Engineering (PULSE): Quilting the Space-Time Fabric with Optical Frequency Combs

RESTORING INJURED BODIES AND BRAINS

Recent advances in neuroscience, microelectronics, and information science are sparking new approaches to restoring lost abilities following brain injury or disease and eventually increasing human performance. Think implantable neural interfaces able to bypass broken circuits in the brain, helping patients overcome injury-induced memory deficits. Or therapeutic neural pulses to mitigate the symptoms of post-traumatic stress disorder. Or prosthetic hands laced with bio-interfaced sensors so an amputee putting on a shirt can "feel" the texture of the fabric and the coolness of the buttons.

Featured Projects:

Electrical Prescriptions (ElectRx)
Hand Proprioception and Touch Interfaces (HAPTIX)
Neuro Function, Activity, Structure, and Technology (Neuro-FAST)
Restoring Active Memory (RAM)
Revolutionizing Prosthetics
System-Based Neurotechnology for Emerging Therapies (SUBNETS)

PROGRAMMING THE LIVING WORLD

Biology is capable of seemingly impossible feats: it can replicate, it can scale from one to billions in hours, it can self-heal, it can learn, and it can evolve. A new technology vector at the intersection of biology, information science, and engineering is launching an era in which biological systems such as microbes can be programmed through the genetic code, enabling us to harness their unparalleled capabilities. DARPA is applying tools from data science, computing, automation, and miniaturization to accelerate the ability to harness biology's synthetic and functional capabilities. The goal is to create revolutionary bio-based manufacturing platforms that can enable new production paradigms, new approaches to medicine, and new materials.

Featured Projects:

Living Foundries

OUTPACING INFECTIOUS DISEASE

As the 2014 Ebola outbreak demonstrated, emerging infectious diseases can be a significant threat not just to individual health but also to the stability of fragile communities. Yet even as the number of emerging diseases has increased, the development of diagnostics, vaccines, and therapeutics has not kept pace. How do we nip infectious disease in the bud? DARPA is developing genetic and immunological technologies to detect, diagnose and treat infectious diseases with unprecedented precision and rapidity, and platforms for predicting the mutational evolution of viruses so drugs and vaccines can be developed before they are needed.

Featured Projects:

Autonomous Diagnostics to Enable Prevention and Therapeutics (ADEPT): Diagnostics on Demand (DxOD); Prophylactic Options to Environmental and Contagious Threats (PROTECT)
Chikungunya Challenge
Microphysiological Systems
Pathogen Predators
Prophecy (Pathogen Defeat)

ROBOTICS FACT VS. FICTION

For decades, we have dreamed of robots that can help people perform tasks beyond the factory floor. But some basic skills are still in need of significant refinement. Compared to human beings and animals, robot mobility and manipulation are still relatively infantile—especially when it comes to operating in disaster zones or other disturbed or extreme environs, where the need for human substitutes is often greatest. DARPA is spurring rapid change in this promising field, developing human-supervised robots that can execute complex tasks in dangerous, degraded environments, as well as increasingly autonomous systems capable of understanding and learning from scenes and events so they can help their human operators become more effective.

Featured Projects:

DARPA Robotics Challenge (DRC)
Legged Squad Support System (LS3)

ENHANCING MARITIME AGILITY

Oceans are strategically central—as a global commons for trade and travel and for global security—but almost incomprehensibly large. DARPA is developing unmanned platforms, distributed sensing systems, and position awareness technology to facilitate access to the vast maritime expanse in all its manifestations, including arctic, littoral, deep water, and continental shelf, and in all of its many sea states.

Featured Projects:

Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV)
Distributed Agile Submarine Hunting (DASH)
Upward Falling Payloads (UFP)

SPACE UNDER CONSTRUCTION

The United States is reliant on space for an ever-growing panoply of conveniences and needs, from telephone calls to bank transactions to military reconnaissance, but space capabilities have not kept up in this radically harsh and challenging domain. To maximize access to and capabilities in space, DARPA is developing a number of game-changing technologies, from new approaches to launching satellites on a day's notice to new satellite architectures that change what's possible on orbit.

Featured Projects:

Phoenix
Star Cell

THE FUTURE OF GROUND WARFARE

Take today's ground conflicts, from violent extremism to hybrid warfare. Add commercial drones, rapid design and production tools, and cyber weapons. These are the new challenges that our Soldiers and Marines face now and into the future. U.S. ground forces will need to complement their superior armor and firepower with new ways to see, understand and control the conflict. DARPA is bringing the digital revolution to close air support and developing a range of squad overmatch capabilities for greater reach, situational awareness and maneuverability.

Featured Projects:

Mathematics of Sensing, Exploitation and Execution (MSEE)
Persistent Close Air Support (PCAS)
Robotic Landing Gear
Warrior Web
Z-Man

E PLURIBUS UNUM

Working together, ants transport leaves and prey dozens of times their collective weight; schools of fish ward off predators by giving the appearance of being more threatening than they are; hundreds of homo sapiens collaborate to improve their daily commute and facilitate overall traffic flow by sharing information about accidents and construction delays. In each of these cases, collective benefits are enjoyed as a result of the seemingly simple actions of individual actors. DARPA is taking these lessons to heart by developing underlying technologies and capabilities such as participatory sensing, swarm robotics, and micro self-assembly that could support similarly collective approaches to overcoming challenges in realms as diverse as surveillance, manufacturing, and transportation.

Featured Projects:

Self-Organizing Resilient Technology (SORT)
SIGMA
Open Manufacturing
Semiconductor Technology Advanced Research Network (STARnet)

WHY IT MATTERS

Explore the many facets of national security in discussions with people who have served on the front lines to help secure it.

Glenn Ayers

Carl "Glenn" Ayers is the Adaptive Execution Office (AEO)'s division chief for U.S. Pacific Command (PACOM) and U.S. Cyber Command (CYBERCOM). A retired U.S. Army colonel, he has more than 29 years of experience in the areas of strategic and operational planning, field artillery operations, influence operations, and information and psychological operations. Ayers' experience includes three years in the private sector, chief of the Psychological Operations Division of the Joint Staff, and military assistant to former U.S. Secretary of Defense Donald Rumsfeld. His peacetime and combat experience includes commanding a 155-mm howitzer battery in the Gulf War, landmine removal operations in Cambodia, and commanding the U.S. Army's 9th Psychological Operations Battalion during high-intensity combat operations in Iraq, while simultaneously deploying attached U.S. Army Reserve companies to Afghanistan. Ayers holds an M.S. in national security strategy from the National Defense University, an M.S. in international relations from Troy State University and a B.A. in anthropology from Wake Forest University.

Kenny Dwyer

Maj. Kenny Dwyer is the executive officer for the 1st Special Warfare Training Group (A) at the U.S. Army's John F. Kennedy Special Warfare Center and School. He was first assigned to 2nd Battalion, 187th Infantry Regiment at Ft. Campbell, Kent., as a rifle platoon leader. Follow-on assignments included battalion mortar platoon leader and company executive officer. In 2003, he attended the Special Forces Assessment and Selection course and the Special Forces Qualification

Course (SFQC). After SFQC, Dwyer was assigned to 1st Battalion 3rd Special Forces Group (SFG) as the team leader of Operational Detachment Alpha 325. He has also served as the 1st Battalion, 3rd SFG (A) assistant operations officer, the 3rd SFG (A) headquarters company commander, Special Forces Command (A) chief of readiness, 3rd SFG (A) Group support company commander, and commander of A Company, 1st Battalion, 1st Special Warfare Training Group (A). Dwyer earned an M.S. in defense analysis from the Naval Post Graduate School and a bachelor's degree from Furman University.

Richard Field

Capt. Richard Field joined DARPA as U.S. Navy operational liaison in 2014. He has served in numerous operational capacities, including executive officer of the USS *Ross* (DDG 71) and commander of the USS *Carney* (DDG 64), which included a deployment to 5th Fleet supporting NATO counter-piracy operations. Ashore he served as the 2nd Fleet Tomahawk Officer, a naval analyst for the Defense Department's Office of Cost Assessment and Program Evaluation, and provided strategic analysis to the Campaign Analysis and Modeling Branch in the Office of the Chief of Naval Operations Assessment Division. His awards and decorations include a Defense Meritorious Service Medal and three Navy Meritorious Service Medals. Field holds an M.A. in national security and strategic studies from the Naval War College, an M.S. in operations research from the Naval Postgraduate School and a B.S. in industrial engineering from Texas A&M University.

Lee Rudacille

Col. Bryan Lee Rudacille joined DARPA as U.S. Army operational liaison in 2014. He has served in various command and staff positions within the Army's mechanized, light and parachute infantry and on multiple occasions in the U.S. Army Special Operations Command. He has multiple operational deployments to Afghanistan and Iraq, most recently serving in 2014 as the chief of staff for the Department of Defense Office of Security Cooperation in the U.S. Embassy in Baghdad. An Army Ranger, Rudacille previously commanded the 1st Ranger Battalion, Hunter Army Airfield, Georgia; the 165th Infantry Brigade, Fort Jackson, South Carolina; and the Joint Multinational Training Command, Grafenwoehr, Germany. His awards and decorations include the Legion of Merit with two Oak Leaf Clusters and the Meritorious Service Medal with three Oak Leaf Clusters. Rudacille holds an M.S. in joint campaign planning and strategy from the National Defense University, an M.M.S. in military studies from the Marine Corps University and a B.S. in automated data processing from the U.S. Military Academy.

John Temple

John Temple has served as a prosecutor in the Trial Division of the New York Country District Attorney's Office since 2003. He began working in the office's Sex Crimes Unit in 2005 and on homicide cases in 2011. In 2012, Temple developed the office's Human Trafficking Program, where he implemented innovative procedures and policies to better identify victims of human trafficking, provide greater support for victims and their families, and use data-based investigations to prosecute traffickers. In 2014, the program was expanded and Temple was appointed to his current position as chief of the office's Human Trafficking Response

Unit. The unit has 28 staff members including attorneys, analysts, sworn investigators and a social worker, and is responsible for proactive and long-term human trafficking investigations and prosecutions. Temple frequently trains law enforcement and other stakeholders in local, national and international settings. He also has served on city and state committees focusing on human trafficking policy. Temple has a J.D. from Brooklyn Law School and a B.A. from the University of Rochester.

Dale Waters

Dale "Muddy" Waters is the director of DARPA's Adaptive Execution Office (AEO). AEO is responsible for accelerating use of DARPA-developed technologies by American combat forces; its primary functions include connecting DARPA program managers to end users in the uniformed Services and sponsoring demonstrations and field trials of new technologies and systems. Waters retired from the U.S. Air Force in 2006 as a brigadier general after 30 years of service flying fighter aircraft. He commanded the Air Force's largest wing during Gulf War combat operations and served in high-level positions in the U.S. State Department and at the National Geospatial Intelligence Agency. He has an M.S. in national security strategy from the National War College, an M.A. in political science from Auburn University and a B.S. in history from the U.S. Air Force Academy.