DEFENSE ADVANCED
RESEARCH PROJECTS AGENCY

Our Research

DARPA's investment strategy begins with a portfolio approach. Reaching for outsized impact means taking on risk, and high risk in pursuit of high payoff is a hallmark of DARPA's programs. We pursue our objectives through hundreds of programs. By design, programs are finite in duration while creating lasting revolutionary change. They address a wide range of technology opportunities and national security challenges. This assures that while individual efforts might fail—a natural consequence of taking on risk—the total portfolio delivers.

https://www.darpa.mil/about-us/people
https://www.darpa.mil/our-research
https://www.darpa.mil/archive/our-research
https://www.darpa.mil/about-us/budget

World Modelers

Dr. Joshua Elliott

The World Modelers program aims to develop technology that integrates qualitative causal analyses with quantitative models and relevant data to provide a comprehensive understanding of complicated, dynamic national security questions. The goal is to develop approaches that can accommodate and integrate dozens of contributing models connected by thousands of pathways—orders of magnitude beyond what is possible today.More

Artificial Intelligence | Automation | Data |

Dr. Stefanie Tompkins

Director, Defense Advanced Research Projects Agency

Dr. Stefanie Tompkins is the director of the Defense Advanced Research Projects Agency (DARPA). Prior to this assignment, she was the vice president for research and technology transfer at Colorado School of Mines.More

Administration | Agency | Leadership |

Dr. Peter Highnam

DEPUTY DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Dr. Peter Highnam is the deputy director of the Defense Advanced Research Projects Agency (DARPA). From January 2020 – September 2020, and from January 2021 – March 2021, he served as the acting director. He joined DARPA as the deputy director in February 2018.More

Administration | Agency | Artificial Intelligence | CBRN | EW | Health | High Performance Computing | Leadership | Sensors |

Dr. David K. Abe

Program Manager, Microsystems Technology Office

Dr. David K. Abe joined DARPA in January 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include vacuum electronics technology, high power microwave and charged particle beam devices and applications, high power millimeter-wave/sub-millimeter-wave amplifiers for sensors and communications, magnetic materials, and radiation effects on microelectronics.More

Communications | Electronics | Energy | Materials | Sensors |

Dr. Lori Adornato

Program Manager, Biological Technologies Office

Dr. Lori Adornato joined DARPA as a Program Manager in July 2017. Her interests include interpretation of organismal behavior and development of bio-inspired materials, as well as platforms and systems for marine sensing applications.More

Chemistry | Maritime | Materials | Sensors |

Dr. Joe Altepeter

Program Manager, Defense Sciences Office

Dr. Joe Altepeter joined DARPA in the Defense Sciences Office in September 2019. His interests include quantum and quantum-inspired technologies, novel sensors and imaging systems, hyperspectral awareness, and the visualization of useful data from complex physical systems.More

Fundamentals | Photonics | Quantum | Spectrum | Visualization |

Dr. Gregory Avicola

Program Manager, Tactical Technology Office

Dr. Gregory Avicola joined DARPA in May 2019 as a program manager in the Tactical Technology Office. Areas of expertise include remote sensing (focus on maritime applications), undersea systems, and naval warfare. He is particularly interested in naval logistics, developing capabilities to exploit undersea mobility, improving both manned and unmanned undersea systems, and enabling undersea autonomous systems.More

Maritime | Unmanned |

Dr. Andrew Baker

Program Manager, Tactical Technology Office

Dr. Andrew Baker joined DARPA in February 2020 as a program manager in the Tactical Technology Office. His research interests include advanced technology development and complex aircraft and weapon system demonstrations ranging from VTOL to hypersonic regimes.More

Air |

Dr. Joshua Baron

Program Manager, Information Innovation Office

Dr. Joshua Baron joined DARPA's Information Innovation Office (I2O) as a program manager in August 2017. His research interests include cryptography, privacy, and anonymity.More

Cyber |

Dr. Ray Bemish

Program Manager, Tactical Technology Office

Dr. Ray Bemish joined DARPA as a program manager in the Tactical Technology Office in July 2021. His interests are in multiscale modeling and related applications of machine learning (ML) and artificial intelligence (AI) as applied to space domain systems. More

Air | Artificial Intelligence | Chemistry | Materials | Space |

Dr. Thomas Beutner

Deputy Director, Tactical Technology Office

Dr. Thomas Beutner joined DARPA to serve as deputy director of the Tactical Technology Office (TTO) in January 2018. Prior to coming to the Agency, he served as the head of the Air Warfare and Weapons Science & Technology Department at the Office of Naval Research (ONR). In this role, Beutner was responsible for the Navy's science and technology investment in aircraft, air, and surface weapons technology programs, and directed energy weapons research. He also served as the Navy's representative on the Office of the Secretary of Defense (OSD) Reliance Air Platforms Panel.More

Leadership |

Dr. Blake Bextine

Program Manager, Biological Technologies Office

Dr. Blake Bextine joined DARPA as a program manager in March 2016, and has served twice as acting deputy director of the Biological Technologies office. He is interested in novel approaches to addressing issues facing agricultural biotechnology and food security, including nucleic acid-based anti-pathogen/anti-pest strategies and insect and plant transformation strategies for rapid trait selection. Additionally, Bextine has focused on the climate conscious approaches to infrastructure development and waste elimination utilizing cutting-edge synthetic biology platforms.More

Bio-complexity | Bio-systems | Disease | Syn-Bio |

Colonel Benjamin Bishop

U.S. Air Force operational liaison, Director's Office

Colonel Benjamin Bishop joined DARPA as a special assistant to the director and U.S. Air Force operational liaison in 2021. More

Air | BMC2 | ISR | Munitions | Space |

Dr. Sergey Bratus

Program Manager, Information Innovation Office

Dr. Sergey Bratus joined DARPA in January 2018 and, after a brief sabbatical, again in March 2022. His research interests include computer security and intrusion analysis.More

Cyber | Systems |

Mr. Thomas "Shotgun" Browning

Director - Adaptive Capabilities Office (ACO), Director's Office

Mr. Thomas Browning is the director of the Adaptive Capabilities Office. In this role Browning is responsible for the management of several highly collaborative efforts to create new joint warfighting constructs and doctrine.More

Adaptability | Complexity | Forecasting | Integration | Systems |

Dr. Adam Bryant

Program Manager, Strategic Technology Office

Dr. Adam Bryant joined DARPA as a program manager in the Strategic Technology Office in May 2019. His research interests include remote sensing systems and signal processing, physics-based modeling and simulation, and data analytics.More

EW | ISR | Maritime | Resilience | Sensors | Space |

Lt Col Paul J. Calhoun

Program Manager, Tactical Technology Office

Lt. Col. Paul Calhoun joined DARPA in June 2020 as a program manager in the Tactical Technology Office (TTO). His areas of research and expertise include human-machine teaming, directed energy, flight test, wireless power transfer, and next-generation aerospace vehicle concepts. More

Air |

Dr. Catherine Campbell

Program Manager, Biological Technologies Office

Dr. Catherine Campbell joined DARPA as a program manager in January 2022. With over two decades of professional experience in molecular and marine biology, microbiology, and bioinformatics, her interests have focused on the analysis of population-based experiments designed to study both human and animal models of disease.More

Bio-complexity | Bio-systems | Maritime | Materials | Sensors |

Dr. William Carter

Program Manager, Defense Sciences Office

Dr. William Carter is a program manager in the Defense Sciences Office. He was formerly the director of the Materials and Microsystems Laboratory at HRL Laboratories. He received his doctorate in applied physics from Harvard University in 1997 and has more than 15 years of experience managing government and industrial materials research programs. His background spans applied physics, materials science, and mechanics.More

Complexity | Fundamentals | Manufacturing | Materials | Microstructures |

Dr. Rohith Chandrasekar

Program Manager, Defense Sciences Office

Dr. Rohith Chandrasekar joined DARPA in the Defense Sciences Office in June 2020. His current interests include static and dynamic planar imaging systems, nonlinear optical devices, and radar systems.More

Fundamentals | Photonics | Sensors | Spectrum | Thermal |

Dr. Anne Cheever

Program Manager, Biological Technologies Office

Dr. Anne Cheever joined DARPA as a program manager in August 2020. She is interested in novel approaches to biosecurity, as well as the use of bioengineering, bioinformatics, and genome editing technologies for innovative biotechnological applications.More

Bio-complexity | Bio-systems | Design | Syn-Bio |

CDR Jean-Paul Chretien

Program Manager, Biological Technologies Office

CDR Jean-Paul Chretien joined DARPA as a program manager in 2020. His interests include disease and injury prevention, operational medicine, and biothreat countermeasures.More

Countermeasures | Disease | Health | Syn-Bio | Therapy |

Dr. Linda Chrisey

Program Manager, Biological Technologies Office

Dr. Linda Chrisey joined DARPA in July 2020 as a program manager in the Biological Technologies Office. Her research interests include synthetic biology, microbial energy harvesting, and the human microbiome.More

Bio-systems | Chemistry | Sensors | Syn-Bio |

LtCol Alan Clarke

Special Assistant to the Director / U.S. Marine Corps Operational Liaison, Director's Office

Lieutenant Colonel Alan Clarke joined DARPA as a special assistant to the director and U.S. Marine Corps operational liaison in 2021.More

Agency |

Dr. Seth Cohen

Program Manager, Biological Technologies Office

Dr. Seth Cohen joined DARPA as a Program Manager in August 2019. He is interested in novel materials, new approaches to therapeutics/countermeasures, and biological and chemical technologies for stabilization/acquisition of scarce resources.More

Chemistry | Countermeasures | Disease | Materials |

Dr. William Corvey

Program Manager, Information Innovation Office

Dr. William Corvey joined DARPA as a program manager in the Information Innovation Office (I2O) in June 2020 to develop, execute, and transition programs in human language technology, artificial intelligence, and related areas.More

Analytics | Data | Language |

Dr. Tatjana Curcic

Program Manager, Defense Sciences Office

Dr. Tatjana Curcic joined DARPA as a program manager in the Defense Sciences Office in October 2018. Her interests are in accelerating the development of quantum information technologies and discovering new applications in a range of areas from sensing to information processing with noisy qubits.More

Processing | Quantum | Sensors |

Mr. John Davies

Program Manager, Microsystems Technology Office

Mr. John Davies joined DARPA in February 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include adaptive radio frequency (RF) systems, artificial intelligence, real-time signal processing, configurable computing, and electronic warfare (EW).More

Artificial Intelligence | Communications | EW | Processing | Sensors |

Dr. Tabitha Dodson

Program Manager, Tactical Technology Office

Dr. Tabitha Dodson joined the Tactical Technology Office as a program manager in August 2021. Her interests are in: advanced space payloads, electric propulsion, astrodynamics, nuclear thermal and nuclear electric propulsion, overall rocket propulsion, advanced nuclear reactors, plasma physics and plasma engineering, nuclear/quantum/particle physics, and hypersonics.More

Air | Energy | Launch | Space |

Dr. Bruce Draper

Program Manager , Information Innovation Office

Dr. Bruce Draper joined DARPA as a program manager in August 2019 to develop, execute, and transition programs in artificial intelligence (AI), computer vision, and machine learning.More

Artificial Intelligence |

Dr. Kerri Dugan

Office Director, Biological Technologies Office

Dr. Kerri Dugan joined DARPA as the deputy director of the Biological Technologies Office in August 2019, and was named director in December 2020.More

Bio-systems | CBRN | Chemistry |

Dr. Thomas Ehrenreich

Program Manager, Microsystems Technology Office

Dr. Thomas Ehrenreich joined DARPA in February 2021 as a program manager in the Microsystems Technology Office (MTO). His research interests include fiber lasers and amplifiers, visible and X-ray spectroscopy, atomic lifetime measurements, ion-atomic collisions, and coherent elliptical Rydberg atoms. More

Energy | Integration | Sensors |

Dr. Joshua Elliott

Program Manager, Information Innovation Office

Dr. Joshua Elliott joined DARPA in September 2017. His research interests include modeling and prediction of complex natural and socio-economic systems and how computational technologies can be leveraged to improve all aspects of science and modeling from data discovery to analysis.More

Analytics | Data | Math |

Dr. Peter Erbland

Program Manager, Tactical Technology Office

Dr. Peter Erbland joined DARPA as a program manager in February 2013. Currently, he focuses on advanced hypersonic systems and technologies including hypersonic aerodynamics and aerothermodynamics, structures and materials, and guidance, navigation and control, as well as basic and applied research in fluid mechanics, laser-based optical diagnostic techniques and numerical modeling.More

Air |

Dr. Anne Fischer

Deputy Director, Defense Sciences Office

Dr. Anne Fischer was named deputy director of the Defense Sciences Office (DSO) in February 2022, after having served as acting deputy director since August 2021. She served as a program manager in DSO from 2017-2021 and will continue to manage the Accelerated Molecular Discovery (AMD) and Rational Integrated Design of Energetics (RIDE) programs. More

Chemistry | Fundamentals | Materials | Tech-Foundations |

Dr. Kathleen Fisher

Deputy Director, Information Innovation Office

Dr. Kathleen Fisher assumed the role of deputy office director for DARPA's Information Innovation Office (I2O) in October 2021. In this role she provides technical leadership and works with program managers to develop, demonstrate, and transition programs, technologies, and capabilities to ensure information advantage for the United States and its allies. More

Artificial Intelligence | Cyber | Data | Networking | Privacy | Processing | Programming | Trust |

Dr. Mark Flood

Program Manager, Information Innovation Office

Dr. Mark Flood joined DARPA as a program manager in the Information Innovation Office (I2O) in June 2020. His research interests include computational finance, financial intelligence, and financial system resilience.More

Analytics | Complexity | Data | Globalization | Logistics | Resilience | Visualization |

Mr. Stephen Forbes

Program Manager, Tactical Technology Office

Mr. Stephen Forbes is a senior research aerospace engineer in the Flight Experiments Division of Space Vehicles Directorate, U.S. Air Force Research Laboratory located at Kirtland Air Force Base in New Mexico. Forbes currently serves as the DARPA program manager for Blackjack on the joint DARPA/Air Force Research Laboratory, and Space and Missile Systems Center programMore

Sensors | Space |

Dr. Juliana Freire

Program Manager, Information Innovation Office

Dr. Juliana Freire joined DARPA in March 2022 to develop, execute, and transition programs in data science, analytics, and visualization.More

Analytics | Data | Visualization |

Col Matthew C. Gaetke

Special Assistant to the Director / U.S. Air Force Operational Liaison, Director's Office

Colonel Matthew Gaetke joined DARPA as a special assistant to the director and U.S. Air Force operational liaison in 2020. More

Air | BMC2 | ISR | Munitions | Space |

Ms. Ryann Glaccum

Program Analyst, Strategic Technology Office

Ms. Ryann Glaccum is a program analyst for the Strategic Technology Office. Prior to joining DARPA in 2020, Glaccum worked at a cybersecurity startup and spent most of her career in management consulting for U.S. government clients. Her previous engagements include providing programmatic and financial technical assistance to a variety of government customers, including the Open Source Integration Center, Innovation Office, and Defense Combating Terrorism Center at the Defense Intelligence Agency; the Intelligence Advanced Research Projects Agency; and DARPA's Microsystems Technology Office. More

Finance |

Maj. Nathan Greiner, USAF

Program Manager, Tactical Technology Office

Maj. Nathan Greiner joined DARPA in July 2018 as a program manager in the Tactical Technology Office. His research interests include advanced power and propulsion technologies for land, sea, air, and space applications.More

Air |

Dr. Benjamin Griffin

Program Manager, Microsystems Technology Office

Dr. Benjamin Griffin joined DARPA in October 2018 as a program manager in the Microsystems Technology Office (MTO). His research interests include MicroElectroMechanical Systems (MEMS), unattended sensors, sensors and electronics for aerospace applications, materials and devices hardened to operate in harsh environments, and RF resonators and filters.More

Electronics | Materials | Sensors | Spectrum

Dr. Timothy Hancock

Program Manager, Microsystems Technology Office

Dr. Timothy M. Hancock joined DARPA as a program manager in September 2016. His research interests revolve around RF microsystem development that spans semiconductor device processing, circuit design and system integration for communication, radar, and electromagnetic spectrum-sensing applications. He is particularly interested in new circuit architectures and the underlying technology development to improve the dynamic range of RF receivers and transmitters in the face of increasing bandwidth to support wideband electromagnetic spectrum operations.More

Decentralization | Electronics | EW | Spectrum |

Mr. Logan Harr

Program Manager, Information Innovation Office

Mr. Logan Harr joined DARPA as a program manager in October 2017. His research interests include cyberspace operations.More

Cyber | Systems |

Lt. Col. Ryan Hefron

Program Manager, Tactical Technology Office

Lt. Col. Ryan "Hal" Hefron joined DARPA as a program manager in July 2021. His areas of research and expertise include advanced autonomy applications for the air domain, applied and theoretical artificial intelligence, human machine teaming, flight test, directed energy, and next-generation aerospace vehicle concepts. More

Air | Artificial Intelligence | Autonomy | Interface |

Dr. Matthew Higgins

Program Manager, Strategic Technology Office

Dr. Matthew Higgins joined DARPA in October 2020 as a program manager in the Strategic Technology Office. Higgins' research interests include electronic warfare applications involving distributed sensing and effecting, electromagnetic coupling, and radio frequency high-power microwave. More

Electronics | EW | Sensors | Spectrum |

Dr. Jonathan Hoffman

Program Manager, Microsystems Technology Office

Dr. Jonathan Hoffman joined DARPA in November 2021 as a program manager in the Microsystems Technology Office (MTO). His research interests include quantum sensing and information science, PNT, optics, and photonics.More

Photonics | PNT | Quantum |

Mrs. Denice Holden

Security, Information Innovation Office

Mrs. Denice Holden is the Program Security Officer for the Information Innovation Office (I2O). She is responsible for ensuring that all I2O information, data and materials requiring safeguarding in the interest of national security are protected as prescribed.More

Administration | Security |

Dr. Bryan Jacobs

Program Manager, Microsystems Technology Office

Dr. Bryan Jacobs joined DARPA as a program manager in the Microsystems Technology Office (MTO) in May 2020. His research interests include co-development of algorithms and novel hardware architectures for optimization, machine learning, biometric encryption, and sensor processing.More

Alternative Computing | Communications | Photonics | Quantum | Sensors | Systems |

Dr. Molly Jahn

Program Manager, Defense Sciences Office

Dr. Molly Jahn joined DARPA as a program manager in the Defense Sciences Office in January 2021 on an Intergovernmental Personnel Act (IPA) assignment from the University of Wisconsin-Madison. Her current research interests focus on leveraging advances in biochemistry and complexity to improving resiliency in critical U.S. infrastructure and supply chains.

More

Bio-systems | Chemistry | Complexity |

Dr. Amy Jenkins

Program Manager, Biological Technologies Office

Dr. Amy Jenkins joined DARPA as a program manager in the Biological Technologies Office (BTO) in June 2019. Her interests include the development of platforms for combatting infectious disease threats as well as novel manufacturing methods to enable rapid response.More

Chemistry | Disease | Health | Manufacturing | Therapy |

Dr. Kristen Jordan

Deputy Director, Biological Technologies Office

Dr. Kristen Jordan joined DARPA as the Deputy Director of the Biological Technologies Office in March 2021.More

Bio-systems | CBRN | Chemistry |

Dr. Thomas Kazior

Program Manager, Microsystems Technology Office

Dr. Thomas E. Kazior joined DARPA in July 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include semiconductor material and device design, fabrication and integration processes including 3D heterogeneous integration (HI) of silicon and compound semiconductor and other non-silicon devices for RF arrays, and microwave/millimeter-wave/sub-millimeter-wave devices for sensors and communications.More

Communications | Design | Integration | Materials | Sensors |

Dr. Gordon Keeler

Program Manager, Microsystems Technology Office

Dr. Gordon Keeler joined DARPA in August 2017 as a Program Manager in the Microsystems Technology Office (MTO). His objective is to accelerate the development of emerging photonics, electronics, and integration technologies to open new pathways toward revolutionary optical microsystems.More

Electronics | Integration | Microsystems | Photonics |

Dr. Ali Keshavarzi

Program Manager, Microsystems Technology Office

Dr. Ali Keshavarzi joined DARPA in August 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include technologies for low-power and high-performance computing, expanding to foundational building blocks of advanced devices, memories, circuits, and architectures for microsystems with embedded intelligence. These intelligent microsystems allow for taking compute to the data for locally processing the data at its source in the field, enabling Edge Intelligence.More

Electronics | High Performance Computing | Microsystems |

Dr. Brian Kettler

Program Manager, Information Innovation Office

Brian Kettler joined DARPA in March 2019. His research interests include automated decision support (AI reasoning and planning), computational modeling of sociocultural systems, human-machine collaboration, and context-aware computing.More

Analytics | Artificial Intelligence | BMC2 |

Ms. Allison Kline

Program Manager, Information Innovation Office

Ms. Allison Kline joined DARPA's Information Innovation Office (I2O) as a program manager in July 2020. Her research interests include cybersecurity, program analysis, emulation, cyberspace operations, and automation.More

Automation | Cyber |

Mr. Andrew Knoedler

Program Manager, Tactical Technology Office

Mr. Andrew Knoedler joined DARPA in July 2018 as a program manager in the Tactical Technology Office. His technical experience includes technology development and demonstration of complex aircraft and weapons systems, with a focus on demonstrating capabilities on shortened timelines.More

Air |

Mr. Aaron Kofford

Program Manager, Strategic Technology Office

Mr. Aaron Kofford joined DARPA in January 2019 as a program manager in the Strategic Technology Office (STO). Kofford has worked on advanced emerging technology projects for NASA, DoD, and the Intelligence Community (IC). He has broad experience in many challenging fields including underwater Positioning, Navigation and Timing (PNT), advanced electronic warfare techniques, small size, weight and power (SWaP) sensor systems, heterogeneous systems of systems, and internal rocket motor ballistics.More

EW | ISR | Maritime | Space |

Mr. Steve Komadina

Program Manager, Tactical Technology Office

Mr. Steve Komadina joined DARPA in July 2019 as a program manager in the Tactical Technology Office. His research interests include technology development, flight demonstration, and prototyping of hypersonic systems; novel planforms/propulsion/controls; autonomous/unmanned air systems; air-to-air weapons; and manned/unmanned teaming.More

Air | Autonomy |

Dr. Greg Kuperman

Program Manager, Strategic Technology Office

Dr. Greg Kuperman joined DARPA in October 2020 as a program manager in the Strategic Technology Office. His research interests include secure communications and networking, distributed edge computing, and open-architecture systems. More

Communications | Data | Mobile | Networking | Space | Systems |

Mr. Michael Langerman

Program Security Officer, Defense Sciences Office

Mr. Michael Langerman is the Program Security Officer for DARPA's Biological Technologies Office (BTO) and Defense Sciences Office (DSO).More

Administration | Security |

Mr. Steven Larsen

Program Support Assistant, Microsystems Technology Office

Mr. Steven Larsen is a Program Support Assistant in the Microsystems Technology Office (MTO).More

Administration |

Dr. Michael Leahy

Office Director, Tactical Technology Office

Dr. Michael Leahy joined DARPA as director of the agency's Tactical Technology Office in May 2019, marking his return to the agency, where he previously led the DARPA/U.S. Air Force Unmanned Combat Air Vehicle Program (X-45A) from conception through first flight.More

Leadership |

Lt. Col. C. David Lewis, USAF

Program Manager, Defense Sciences Office

Lt. Col. C. David Lewis joined DARPA as a program manager in the Defense Sciences Office (DSO) in January 2018. Trained as an officer and physicist, Lt. Col. Lewis is interested in applying the forefront of fundamental physics in unique ways to DoD challenges using the disciplines of quantum mechanics, space and plasmas, and gravitational physics.More

Fundamentals | Math | Quantum | Space |

Dr. Jeff Maas

Program Manager, Strategic Technology Office

Dr. Jeff Maas joined DARPA in April 2018 as a program manager in the Strategic Technology Office. Dr. Maas' research interests include electronic warfare applications involving distributed systems, real-time effectiveness monitoring, and strategic employment concepts.More

A2/AD | Autonomy | Countermeasures | EW | PNT |

Mr. Hamish Malin

Program Manager, Tactical Technology Office

Mr. Hamish Malin joined DARPA's Tactical Technology Office in February 2021 with more than two decades of leadership experience in both the government and industry. Malin's technical expertise includes precision guided munitions, weapon sensor and seeker technologies, GPS-denied navigation, telemetry, and gun-hardened electromechanical systems. His program management duties have spanned project initiation, project execution, and direction of product fielding. He is particularly interested in developing novel technologies to expand naval surface engagement capabilities.More

Maritime | Munitions | Systems | Targeting |

Ms. Jessica P. Marsh

Assistant Director, Program Management, Strategic Technology Office

Ms. Jessica P. Marsh is the Assistant Director, Program Management for the Strategic Technology Office. She was previously a Program Analyst for the Strategic Technology Office.More

Finance |

Mr. William Martin

Program Manager, Information Innovation Office

Mr. William Bradley Martin joined DARPA as a program manager in the Information Innovation Office (I2O) in April 2021. His research interests include the development of capabilities in support of achieving continuous reasoning of complex high assurance systems. More

Automation | Cyber | Formal | Trust |

Dr. Whitney Mason

Program Manager, Microsystems Technology Office

Dr. Whitney Mason joined DARPA as a program manager in the Microsystems Technology Office (MTO) in November 2017. Her research interests are in imaging sensors that provide multi-function capability. In particular, she is interested in novel device structures, optics, and electronics that enable new capabilities compared to current state of the art imaging systems.More

Imagery | Sensors | Spectrum |

Ms. Lisa Mattocks

Assistant Director, Program Management, Information Innovation Office

Ms. Lisa Mattocks is the assistant director for program management (ADPM) in the Information Innovation Office.More

Administration | Contracts | Finance |

Dr. Carl McCants

Special Assistant to the DARPA Director, Microsystems Technology Office

Dr. Carl E. McCants is a special assistant to the DARPA director, focusing on the Microsystems Technology Office's (MTO) Electronics Resurgence Initiative (ERI) and the National Network for Microelectronics Research and Development.More

Electronics | Leadership | Microsystems |

Dr. Tristan McClure-Begley

Program Manager, Biological Technologies Office

Dr. Tristan McClure-Begley joined DARPA as a Program Manager in October 2017. His scientific pursuits at the agency involve novel chemical biology approaches to treating disease and injury, and developing methods to accelerate and protect learning and executive functions.More

Bio-complexity | Disease | Therapy |

Ms. Karen McMullen

Program Analyst, Defense Sciences Office

Ms. Karen McMullen has been with DARPA since 1987. She has served as a program/financial analyst for a variety of major DARPA technical offices, including: Advanced Systems, Tactical Technology, Information Awareness, Joint Unmanned Combat Air Systems, Special Projects and Strategic Technology.McMullen joined DSO as the program analyst in 2014.More

Administration | Finance |

Mr. Bernard McShea

Program Manager, Information Innovation Office

Mr. Bernard McShea joined DARPA in August 2021 as a program manager in the Information Innovation Office (I2O) to develop, execute, and transition programs in machine learning and cybersecurity.More

Cyber |

Mr. John-Francis Mergen

Program Manager, Information Innovation Office

Mr. John-Francis Mergen joined DARPA as a program manager in January 2020 to develop, execute, and transition programs in cybersecurity.More

Cyber |

Dr. Sandeep Neema

Program Manager, Information Innovation Office

Dr. Sandeep Neema joined DARPA in July 2016 and again in September 2020. His research interests include cyber physical systems, model-based design methodologies, distributed real-time systems, and mobile software technologies.More

Cyber | Mobile | Systems |

Dr. Andrew Nuss

Program Manager, Tactical Technology Office

Dr. Andrew Nuss joined DARPA in November 2017 as a program manager in the Tactical Technology Office. His current focus areas include unmanned maritime systems, robotic naval systems, advanced maritime architectures and their rapid fielding, and novel approaches to increase platform survivability.More

Maritime |

Dr. Allyson O'Brien

Program Manager, Information Innovation Office

Dr. Allyson O'Brien joined DARPA in January 2022 to develop, execute, and transition programs in quantum information and cybersecurity.More

Cyber | Quantum |

Dr. Dev Palmer

Deputy Director, Microsystems Technology Office

Dr. Dev Palmer was named Deputy Director of the Microsystems Technology Office (MTO) in April 2020. Prior to his appointment, he was Chief Technologist at the Lockheed Martin Advanced Technology Laboratories, where he directed the independent research and development program and worked with the senior leadership team to define and execute technology strategy.More

Leadership |

Mr. Joshua Parsons

Assistant Director, Program Management, Tactical Technology Office

Mr. Joshua Parsons is the Assistant Director, Program Management for the Tactical Technology Office. He joined DARPA in 2018 and was the TTO Program Analyst until 2021. Prior to joining DARPA he served at the Office of the Director of National Intelligence (ODNI) as the Chief of Plans, Budget and Execution for the Intelligence Advanced Research Projects Activity (IARPA) followed by becoming the portfolio manager of budget and space acquisition policy for the National Intelligence Manager for Space and Technical Intelligence.More

Administration | Finance |

Mr. Tejas Patel

Program Manager, Information Innovation Office

Mr. Tejas Patel joined DARPA as a program manager in August 2019 to develop, execute, and transition programs in cyberspace operations and other defense mission areas.More

Analytics | Automation | Cyber | Data |

Dr. Matthew Pava

Program Manager, Biological Technologies Office

Dr. Matthew Pava joined DARPA as a program manager in March 2021. He is interested in biotechnologies that address challenges in infrastructure sustainment, emergent care for battlefield trauma, and mitigating the impact of sleep loss on health and human performance.More

Bio-systems | Health | Injury | Neuroscience | Restoration | Syn-Bio |

Dr. Ken Plaks

Deputy Director, Strategic Technology Office

Dr. Ken Plaks was named acting director of the Strategic Technology Office (STO) in December 2021. From July 2020 till December 2021 he served as deputy director of STO. More

Cyber | EW | Materials |

Dr. Jeffrey Rogers

Program Manager, Strategic Technology Office

Dr. Jeffrey Rogers joined DARPA as a program manager in the Strategic Technology Office in February 2019. His interests include physics-based signal and sensor array processing with applications to radio frequency (RF) and acoustic systems, multi-domain and multi-sensor fusion, space weather and ionospheric modeling, and metamaterials. Prior to DARPA, Rogers spent 8 years as an electrical engineer and head of the Active Acoustics Section within the Acoustics Division at Naval Research Laboratory. While at Naval Research Laboratory, he led a portfolio of research programs focused on acoustic applications in anti-submarine warfare (ASW).More

Electronics | EW | Materials | Sensors |

Dr. Tom Rondeau

Program Manager, Strategic Technology Office

Dr. Tom Rondeau became a program manager in the Strategic Technology Office in May 2020, after serving as a program manager in the Microsystems Technology Office.More

Adaptability | Communications | Spectrum |

Dr. Philip Root

Office Director, Strategic Technology Office

Army Lt. Col. (ret) Philip Root, PhD, was named director of the Strategic Technology Office (STO) in February 2022. He previously served as the Defense Sciences Office's (DSO's) deputy director and acting director from June 2019 until moving to STO. He previously served as program manager within the DARPA's Tactical Technology Office (TTO) where he explored the intersection of AI, autonomy, and military operations. More

Ground |

Dr. Mark Rosker

Office Director, Microsystems Technology Office

Dr. Mark Rosker became director of DARPA's Microsystems Technology Office (MTO) in April 2019. Prior to this, he was deputy director of Defense Sciences Office (DSO) beginning in April 2018.More

Fundamentals | Leadership |

Dr. Kevin Rudd

Program Manager, Strategic Technology Office

Dr. Kevin Rudd joined DARPA in May 2020 as a program manager in the Strategic Technology Office (STO). His interests include information warfare, electronic warfare, radio frequency sensing, machine learning, and artificial intelligence for DoD applications.More

Air | Artificial Intelligence | EW | ISR | Space |

Dr. Lael Rudd

Program Manager, Tactical Technology Office

Dr. Lael Rudd joined DARPA in March 2020 as a program manager in the Tactical Technology Office. His expertise is in advanced autonomy systems for space and air domains.More

Air | Autonomy | Space |

Dr. Bartlett Russell

Program Manager, Defense Sciences Office

Dr. Bartlett Russell joined DARPA as a program manager in April of 2019. Her work focuses on understanding the variability of human cognitive and social behavior to enable the decision-maker, improve analytics, and generate autonomous and AI systems that enable human adaptability. Prior to joining DARPA, Russell was a senior program manager and lead of the human systems and autonomy research area in Lockheed Martin's Advanced Technology Laboratories.More

Analytics | Artificial Intelligence | Autonomy | Forecasting | Integration | Interface | Neuroscience | Resilience | Training | Trust | Visualization |

Dr. Rob Saperstein

Program Manager, Strategic Technology Office

Dr. Rob Saperstein joined DARPA in June 2018 as a program manager for the Strategic Technology Office. His interests lie in technologies and systems for optical reconnaissance (ISR), electronic support, tactical optical networks, and verification of effectiveness.More

ISR | Networking | Spectrum |

Ms. Ana Saplan

Program Manager, Tactical Technology Office

Ms. Ana Saplan joined DARPA in July 2018 as a program manager in the Tactical Technology Office. Her current focus areas include spaceflight hardware development, robotic systems, and on-orbit satellite servicing. More

Cost | Policy | Robotics | Satellites | Space |

Dr. Gopal Sarma

Program Manager, Biological Technologies Office

Dr. Gopal Sarma joined DARPA as a program manager in November 2021. A physician-scientist with a background in mathematics, physics, data science, and software engineering, he is broadly interested in the interface between machine learning and the life sciences, with a focus on physiological measurement and detection technologies for biodefense. More

Artificial Intelligence | Bio-systems | Disease | Health |

Dr. William Scherlis

Office Director, Information Innovation Office

Dr. William Scherlis assumed the role of office director for DARPA's Information Innovation Office (I2O) in September 2019. In this role he leads program managers in the development of programs, technologies, and capabilities to ensure information advantage for the United States and its allies, and coordinates this work across the Department of Defense and U.S. government.More

Artificial Intelligence | Cyber | Data | Networking | Privacy | Processing | Programming | Trust |

Dr. Mary R. Schurgot

Program Manager, Strategic Technology Office

Dr. Mary R. Schurgot joined DARPA in March 2020 as a program manager in the Strategic Technology Office (STO). Her research interests include secure and efficient data sharing, automated decision aids, and the design of new networking and communication paradigms.More

Communications | Data | Networking |

Mr. Ted Senator

Program Manager, Defense Sciences Office

Mr. Ted Senator joined DARPA as a program manager in the Defense Sciences Office in August 2018. Senator was a senior science advisor at the National Geospatial-Intelligence Agency, focusing on uses of artificial intelligence and machine learning. He has been a program manager at both the Intelligence Advanced Research Projects Activity (IARPA) and the Defense Advanced Research Projects Agency (DARPA), as well as the founder and leader of the Artificial Intelligence Division at the U.S. Treasury's Financial Crimes Enforcement Network (FinCEN) and an engineer for the Department of the NavyMore

Agency | Ground | Opportunities | Transition |

Dr. Paul Sheehan

Program Manager, Biological Technologies Office

Dr. Paul Sheehan joined DARPA as a program manager in the Biological Technologies Office in July 2017. Dr. Sheehan will focus on new nanoscale methods for biological sensing that could be coupled with advanced engineering and electronics. His interests involve the bi-directional conversion between electronic and biochemical signals, the study of how nanostructures interact with cells and biomolecules, and new approaches for the rapid development and manufacture of bioassays.More

Manufacturing | Materials | Sensors |

Mr. Chris Simi

Program Manager, Strategic Technology Office

Mr. Chris Simi joined DARPA as a program manager in the Strategic Technology Office in September 2018. Prior to DARPA, Simi spent 15 years in the research office of the National Geospatial Intelligence Agency (NGA). At NGA, Mr. Simi served as the senior scientist for remote sensing, developing a large variety of advanced electro-optic systems and concepts.More

EW | Imagery | ISR | Maritime | Satellites | Space |

Dr. Richard Singer

Program Manager, Tactical Technology Office

Dr. Richard Singer joined DARPA in March 2021 as a program manager in the Tactical Technology Office. His research interests include novel methods for thermal control of spacecraft, advanced materials as mission enablers, enhanced space domain awareness, and advanced on-orbit operations. He has an extensive background in visible and infrared focal plane arrays and microelectromechanical devices.More

ISR | Materials | Microstructures | Satellites | Spectrum |

Mrs. Wendy Smith

Assistant Director, Program Management, Microsystems Technology Office

Mrs. Wendy Smith joined the DARPA Microsystems Technology Office as the assistant director for program management (ADPM) in August 2015. She serves as the overall business/financial manager for the office.More

Administration | Contracts | Finance |

Lt. Col. Joshua Stults

Program Manager, Tactical Technology Office

Lt. Col. Joshua Stults became a program manager in the Tactical Technology Office in April 2018 after serving as a deputy program manager in the agency. His expertise includes high-speed flight, munitions, and novel propulsion technologies, with a focus on hypersonics.More

Air |

Dr. Vishnu Sundaresan

Program Manager, Defense Sciences Office

Dr. Vishnu Sundaresan joined DARPA as a program manager in the Defense Sciences Office in September 2020. His current interests include high-energy density energy storage devices, quantum effects in soft matter, structural computing for the next generation of mechatronic systems, advanced concepts in metrology, and novel chemistries for emerging manufacturing paradigms. At DARPA, Sundaresan looks to bring together the fundamentals of chemical physics of materials, dynamics and control theory, and structural design to develop novel device architectures for a broad portfolio of applications.More

Chemistry | Fundamentals | Materials |

CDR Greg Sutton

Program Manager, Strategic Technology Office

Cmdr. Greg Sutton joined DARPA in August 2019 as a program manager in the Strategic Technology Office (STO). His research interests include maritime access; offensive non-kinetics; and novel maritime tagging, tracking, and locating concepts.More

Maritime | Sensors |

CDR Matthew Thatcher

Special Assistant to the Director, U.S. Navy Operational Liaison, Director's Office

Commander Matthew Thatcher joined DARPA in 2020 as a special assistant to the director and U.S. Navy operational liaison.More

Agency | Maritime | Opportunities | Transition |

Ms. Courtney Tomlinson

Program Analyst, Information Innovation Office

Ms. Courtney Tomlinson is the Program Analyst for the Information Innovation Office. More

Administration | Contracts | Finance |

Dr. Matt Turek

Program Manager, Information Innovation Office

Dr. Matt Turek joined DARPA's Information Innovation Office (I2O) as a program manager in July 2018, and was named Acting Deputy Director of I2O in June 2021.More

Algorithms | Analytics | Artificial Intelligence | Imagery | ISR | Trust |

Dr. Eric Van Gieson

Program Manager, Biological Technologies Office

Dr. Eric Van Gieson joined DARPA as a Program Manager in August 2017 with the goal of using host-based methods to mitigate the impacts of emerging disease threats. He intends to explore epigenetic and real-time monitoring approaches that can dynamically guide healthcare decisions and therapy, and new methods of increasing patient survival in austere environments using intelligent systems partnered with local care providers.More

Disease | Forecasting | Health | Systems |

Dr. Alexander M. G. Walan

Program Manager, Tactical Technology Office

Dr. Alexander Walan joined DARPA in September 2017 as a program manager in the Tactical Technology Office. His current focus areas include technology development and demonstration of advanced aircraft technologies with particular focus on rapid design, prototyping, and flight demonstration.More

Air | Maritime |

COL Allen Walker

Special Assistant to the Director / U.S. Army Operational Liaison, Director's Office

Colonel Allen Walker joined DARPA as a special assistant to the director and U.S. Army operational liaison in 2019. He previously served as the Branch Chief of Maneuver Support in the Director of Force Management, G-3/5/7, Department of the Army.More

Agency | Opportunities | Transition |

Mr. John Waterston

Program Manager, Strategic Technology Office

Mr. John Waterston was named acting deputy director of the Strategic Technology Office (STO) in December 2021. He served as program manager in STO from 2017-2021 and continues to manage the Ocean of Things; Phorcys; and Spatial, Temporal, and Orientation Information in Contested Environments (STOIC) programs. Waterston’s interests are in maritime autonomy, undersea warfare, distributed sensing, and non-traditional communications.More

Communications | Maritime | Sensors |

Mr. Walter Weiss

Program Manager, Information Innovation Office

Mr. Walter Weiss joined DARPA's Information Innovation Office (I2O) as a program manager in July 2017. His research interests focus on cybersecurity operations.More

Cyber |

Mr. Scott Wenzel

Assistant Director, Program Management , Defense Sciences Office

Scott Wenzel is the Assistant Director for Program Management (ADPM) in the Defense Sciences Office (DSO).More

Administration | Finance |

Dr. Matthew Wilding

Program Manager, Information Innovation Office

Dr. Matthew Wilding joined DARPA in March 2022 to develop, execute, and transition programs in software engineering and critical system assurance.More

Automation | Cyber | Formal | Trust |

Dr. James Wilson

Program Manager, Microsystems Technology Office

Dr. James Wilson joined DARPA in July 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include the development of radio frequency (RF), analog, and digital circuits that push the power and performance envelope; novel topologies enabled through heterogeneous integration; and the applications of electronics to enable new RF, EW, and communication opportunities. He is particularly interested in increasing the energy efficiency of electronics to enable ubiquitous, high performance systems for wideband electromagnetic spectrum operations.More

Communications | EW | Integration | Sensors | Spectrum |

Dr. Greg Witkop

Program Manager, Defense Sciences Office

Dr. Greg Witkop, MD, joined DARPA as a program manager in the Defense Sciences Office in June 2021. Prior to joining DARPA, he led several FBI credibility assessment research efforts. His current research interests focus on leveraging advances in neuroscience, non-invasive physiological monitoring, and unsupervised machine learning, to enhance credibility assessment, suicide prevention, and high-performance learning. More

Cognitive Science | Health | Interface | Training |

CDR Kyle Woerner

Program Manager, Tactical Technology Office

Cmdr. Kyle Woerner joined DARPA in September 2018 as a program manager in the Tactical Technology Office. His interests include unmanned systems, offensive and defensive swarms, undersea influence, multi-domain teaming, and human-machine interactions.More

Maritime | Unmanned |

Dr. Jason Woo

Program Manager, Microsystems Technology Office

Dr. Jason C. S. Woo joined DARPA in September 2020 as a program manager in the Microsystems Technology Office (MTO). His research interests include VLSI technology, ultra-scaled semiconductor device design, fabrication, and integration processes for both high performance and low power digital, analog, and RF applications.More

Design | Integration | Quantum |

Dr. Mark Wrobel

Program Manager, Defense Sciences Office

Dr. Mark Wrobel joined DARPA as a program manager in the Defense Sciences Office in 2019. His interests include the development of new capabilities for detecting and interdicting threats associated with weapons of mass destruction, including chemical, biological, radiological and nuclear threats to national security.More

Fundamentals | Sensors |

Dr. Lok Yan

Program Manager, Microsystems Technology Office

Dr. Lok Yan joined DARPA in November 2021 as a program manager in the Microsystems Technology Office (MTO). His research interests are in systems security, hardware/software co-design, and automated analysis and synthesis.More

Analytics | Automation | Design | Systems |

Dr. Stuart H. Young

Program Manager, Tactical Technology Office

Stuart Young joined DARPA in January 2020 as a program manager in the Tactical Technology Office. His expertise includes autonomous/unmanned ground and air vehicles, intelligent behaviors for unmanned systems, multi-agent teaming, applied artificial intelligence (AI) and machine learning (ML), and field robotics technologies.More

Air | Autonomy | Ground | Unmanned |

Dr. Paul Zablocky

Program Manager, Strategic Technology Office

Dr. Paul Zablocky joined DARPA as a program manager in the Strategic Technology Office in September 2018. Zablocky's previous positions include Navy, Marine, and Army R&D experience.More

Analytics | BMC2 | Complexity | Ground | Resilience |

Mr. Adam Zimet

Program Analyst , Tactical Technology Office

Mr. Adam Zimet joined DARPA in August 2020 as the program analyst in the Tactical Technology Office.

Accelerated Molecular Discovery (AMD)

Dr. Anne Fischer

Efficient discovery and production of new molecules is essential to realize capabilities across the DoD, from simulants and medicines essential to counter emerging threats, to coatings, dyes and specialty fuels needed for advanced performance.More

Artificial Intelligence | Automation | Autonomy | Chemistry | COVID-19 | Data | Fundamentals | Integration |

Active Interpretation of Disparate Alternatives (AIDA)

Dr. William Corvey

The United States Government has an interest in developing and maintaining a strategic understanding of events, situations, and trends around the world, in a variety of domains. The information used in developing this understanding comes from many disparate sources, in a variety of genres, and data types, and as a mixture of structured and unstructured data. Unstructured data can include text or speech in English and a variety of other languages, as well as images, videos, and other sensor information.More

Analytics | Artificial Intelligence | Autonomy | Data | Imagery | Language |

Active Social Engineering Defense (ASED)

Mr. Walter Weiss

Over the past 40 years, our world has become increasingly connected. These connections have enabled major advances in national security from pervasive real-time intelligence and communications to optimal logistics. With this connectivity has come the threat of cyber attacks on both military systems and critical infrastructure. While we focus the vast majority of our security efforts on protecting computers and networks, more than 80 percent of cyber attacks and over 70 percent of those from nation states are initiated by exploiting humans rather than computer or network security flaws. To build secure cyber systems, it is necessary to protect not only the computers and networks that make up these systems but their human users as well..More

Autonomy | Cyber |

Adapting Cross-Domain Kill-Webs (ACK)

Dr. Greg Kuperman

The goal of the Adapting Cross-Domain Kill-Webs (ACK) program is to provide a decision aid for mission commanders to assist them with rapidly identifying and selecting options for tasking – and retasking – assets within and across organizational boundaries.More

BMC2 | Decentralization | Opportunities | Resilience |

ADvanced Acclimation and Protection Tool for Environmental Readiness (ADAPTER)

Dr. Paul Sheehan

Warfighters are travelers, and the bodily inconveniences suffered by travelers, such as jet lag and traveler's diarrhea, can seriously degrade operational readiness and even determine mission success or failure. To maximize warfighter performance, the ADvanced Acclimation and Protection Tool for Environmental Readiness (ADAPTER) program will develop systems that provide warfighters greater control over their own physiology.More

Countermeasures | Disease | Health | Med-Devices | Therapy |

Advanced Concept Compact Electron Linear-accelerator (ACCEL)

Dr. Matthew Higgins

Linear accelerators, LINACs for short, are devices that accelerate electrons or other sub-atomic particles along a straight line to generate a beam of high energy. LINACs have a variety of commercial uses such as generating X-rays for cargo inspection, medical diagnostics, food sterilization, and even enabling precise external radiation treatments to destroy cancer cells without damaging surrounding tissue. To generate more powerful electron beams using current technology, however, requires building larger LINACs that can grow to dozens of meters or longer depending on the application. Unfortunately, powerful LINACs are too large and heavy to be practical for military use in the field.More

EM Waves | Ground | Health |

Advanced Full Range Engine (AFRE)

Maj. Nathan Greiner, USAF

In the decades-long quest to develop reusable aircraft that can reach hypersonic speeds – Mach 5 (approximately 3,300 miles per hour/5,300 kilometers per hour) and above – engineers have grappled with two intertwined, seemingly intractable challenges: The top speed of traditional jet-turbine engines maxes out at roughly Mach 2.5, while hypersonic engines such as scramjets cannot provide effective thrust at speeds much below Mach 3.5.More

Air |

Advanced Plant Technologies (APT)

Dr. Blake Bextine

The Advanced Plant Technologies (APT) program seeks to develop plants capable of serving as next-generation, persistent, ground-based sensor technologies to protect deployed troops and the homeland by detecting and reporting on chemical, biological, radiological, nuclear, and explosive (CBRNE) threats. Such biological sensors would be effectively energy-independent, increasing their potential for wide distribution, while reducing risks associated with deployment and maintenance of traditional sensors. These technologies could also potentially support humanitarian operations by, for example, detecting unexploded ordnance in post-conflict settings.More

Bio-complexity | Bio-systems | Sensors | Syn-Bio |

Aerial Dragnet

Dr. Paul Zablocky

Airspace for the flying public today is perpetually congested yet remarkably safe, thanks in no small part to a well-established air traffic control system that tracks, guides and continuously monitors thousands of flights a day. When it comes to small unmanned aerial systems (UAS) such as commercial quadcopters, however, no such comprehensive tracking system exists. And as off-the-shelf UAS become less expensive, easier to fly, and more adaptable for terrorist or military purposes, U.S. forces will increasingly be challenged by the need to quickly detect and identify such craft—especially in urban areas, where sight lines are limited and many objects may be moving at similar speeds.More

ISR | Processing | Sensors | SWAP | Systems | Unmanned |

Agile Teams (A-Teams)

Dr. Greg Witkop

The Agile Teams (A-Teams) program aims to discover, test, and demonstrate generalizable mathematical abstractions for the design of agile human-machine teams and to provide predictive insight into team performance.More

Autonomy | Complexity | Interface | Math | Systems |

AI-assisted Climate Tipping-point Modeling (ACTM)

Dr. Joshua Elliott

The program objective is to explore AI-assisted modeling of complex processes related to climate. More

Artificial Intelligence | Bio-complexity | Data | Forecasting | ML | Uncertainty |

Air Combat Evolution (ACE)

Lt. Col. Ryan Hefron

The ACE program seeks to increase trust in combat autonomy by using human-machine collaborative dogfighting as its challenge problem. This also serves as an entry point into complex human-machine collaboration. ACE will apply existing artificial intelligence technologies to the dogfight problem in experiments of increasing realism. In parallel, ACE will implement methods to measure, calibrate, increase, and predict human trust in combat autonomy performance.More

Air | Algorithms | Artificial Intelligence | Autonomy | Trust |

Aircrew Labor In-Cockpit Automation System (ALIAS)

Dr. Stuart H. Young

Military aircraft have evolved to incorporate ever more automated capabilities, improving mission safety and success rates. Yet operators of even the most automated aircraft must still manage dauntingly complex interfaces and be prepared to respond effectively in emergencies and other unexpected situations that no amount of training can fully prepare one for.More

Air | Autonomy | Cost | Unmanned |

All Together Now (ATN)

Dr. Tatjana Curcic

The goal of All Together Now (ATN) is to develop theoretical protocols and experimental techniques that enable new collective atom regimes, leading to sensitivities approaching the ultimate fundamental limits of performance.More

Fundamentals | Photonics | PNT | Quantum |

Applications Resulting from Recent Insights in Vacuum Engineering (ARRIVE)

Lt. Col. C. David Lewis, USAF

The Applications Resulting from Recent Insights in Vacuum Engineering (ARRIVE) program is carrying out proof-of-theory experiments aimed at engineering vacuum fluctuations in photonic and mechanical systems. A follow-on to the DARPA QUEST program, ARRIVE will experimentally test new theoretical insights into controlling the quantum vacuum, and transducing the vacuum energy density into a usable form. More

Fundamentals | Metamaterials | Photonics | Quantum |

Artificial Social Intelligence for Successful Teams (ASIST)

Dr. Joshua Elliott

Humans intuitively combine pre-existing knowledge with observations and contextual clues to construct rich mental models of the world around them and use these models to evaluate goals, perform thought experiments, make predictions, and update their situational understanding. When the environment contains other people, humans use a skill called theory of mind (ToM) to infer their mental states from observed actions and context, and predict future actions from those inferred states.More

Artificial Intelligence | Autonomy | Interface |

Assured Autonomy

Dr. Sandeep Neema

Autonomy refers to a system's ability to accomplish goals independently, or with minimal supervision from human operators in environments that are complex and unpredictable. Autonomous systems are increasingly critical to several current and future Department of Defense (DoD) mission needs.More

Autonomy | Systems |

Assured Micropatching (AMP)

Dr. Sergey Bratus

Our society's infrastructure is increasingly dependent on software deployed on a wide variety of computing devices other than commodity personal computers, such as industrial equipment, automobiles, and airplanes. Unlike commodity computers that have short upgrade cycles and are easily replaceable in case of failure, these computing devices are intended for longer service, and are hard to replace.More

Cyber | Systems |

Atmosphere as a Sensor (AtmoSense)

Lt. Col. C. David Lewis, USAF

The Atmosphere as a Sensor (AtmoSense) program is a fundamental science program that seeks to understand the propagation of mechanical and electromagnetic energy from the surface of the Earth through the Earth's ionosphere due to transient events such as meteorological sources, geophysical sources, prompt hazards, etc. For example, an event on the surface of the Earth, such as a volcanic eruption, will produce radially outward longitudinal mechanical perturbations on the atmosphere.More

Space |

Atmospheric Water Extraction (AWE)

Dr. Seth Cohen

Water transport is as mission-critical and as logistically challenging as fuel transport for the U.S. military. Meeting deployed military water needs requires equipment resources, consumes fuel, and endangers personnel. The goal of DARPA's Atmospheric Water Extraction (AWE) program is to provide potable freshwater for a range of military, stabilization, and humanitarian needs through the development of small, lightweight, low-powered, distributable systems that extract potable water from the atmosphere to meet the drinking needs of individuals and groups, even in extremely arid climates.More

Decentralization | Logistics | Materials | Stabilization | SWAP |

Atomic Clock with Enhanced Stability (ACES)

Dr. Dev Palmer

Precise timing is essential across DoD systems, including communications, navigation, electronic warfare, intelligence systems reconnaissance, and system-of-systems platform coordination, as well as in national infrastructure applications in commerce and banking, telecommunications, and power distribution. Improved clock performance throughout the timing network, particularly at point-of-use, would enable advanced collaborative capabilities and provide greater resilience to disruptions of timing synchronization networks, notably by reducing reliance on satellite-based global navigation satellite system (GNSS) timing signals.More

Communications | Decentralization | ISR | Microsystems | PNT | Quantum |

Atomic Magnetometer for Biological Imaging In Earth's Native Terrain (AMBIIENT)

Dr. Jonathan Hoffman

State-of-the-art magnetometers are used for diverse civilian and DoD applications, among them biomedical imaging, navigation, and detecting unexploded ordnance and underwater and underground anomalies. Commercially available magnetometers range from inexpensive Hall probes to highly sensitive fluxgate and atomic magnetometers to high-precision Superconducting Quantum Interference Device (SQUID) and Spin Exchange Relaxation Free (SERF) magnetometers.More

Med-Devices | Sensors | Tech-Foundations |

Atomic-Photonic Integration (A-PhI)

Dr. Thomas Ehrenreich

Atom-based devices have proven to be the most accurate means of measuring the physical world. Two areas of great promise are frequency metrology using optically probed trapped atom clocks and inertial sensing using optically cooled atom interferometry. Together, they could form the basis of a fully autonomous navigation and timing system, free from GPS. However, replicating these devices even at laboratory scale is still resource intensive, while integration of these laboratory-based quantum devices into a practical size, weight, and power has proven very challenging.More

Integration | Photonics |

Automated Rapid Certification Of Software (ARCOS)

Mr. William Martin

The process of determining that a software system's risk is acceptable is referred to as "certification." Current certification practices within the Department of Defense (DoD) are antiquated and unable to scale with the amount of software deployed. Two factors prevent scaling: (a) the use of human evaluators to determine if the system meets certification criteria, and (b) the lack of a principled means to decompose evaluations.More

Cyber | Formal | Trust |

Automatic Implementation of Secure Silicon (AISS)

Dr. Lok Yan

The Automatic Implementation of Secure Silicon (AISS) program aims to ease the burden of developing secure chips. AISS seeks to create a novel, automated chip design flow that will allow security mechanisms to scale consistently with the goals of a chip design. The target design flow will provide a means of rapidly evaluating architectural alternatives that best address the required design and security metrics, as well as varying cost models to optimize the economics versus security trade-off. The target system on chip (SoC) – will be automatically generated, integrated, and optimized, and will consist of two partitions – an application specific processor partition and a security partition implementing the on-chip security features. By bringing greater automation to the chip design process, the burden of security inclusion can be profoundly decreased.More

Automation | Cyber | Design | Security |

Automating Scientific Knowledge Extraction (ASKE)

Dr. Joshua Elliott

The Automating Scientific Knowledge Extraction (ASKE) program aims to develop technology to automate some of the manual processes of scientific knowledge discovery, curation and application. ASKE is part of DARPA's Artificial Intelligence Exploration (AIE) program, a key component of the agency's broader AI investment strategy aimed at ensuring the United States maintains an advantage in this critical and rapidly accelerating technology area.More

Algorithms | Analytics | Artificial Intelligence | Data |

Autonomous Diagnostics to Enable Prevention and Therapeutics (ADEPT)

Dr. Amy Jenkins

The Autonomous Diagnostics to Enable Prevention and Therapeutics (ADEPT) program supports individual troop readiness and total force health protection by developing technologies to rapidly identify and respond to threats posed by natural and engineered diseases and toxins. A subset of ADEPT technologies specifically support use by personnel with minimal medical training, delivering centralized laboratory capabilities even in the low-resource environments typical of many military operations. The program is part of a portfolio of DARPA-funded research aimed at providing options for preempting or mitigating constantly evolving infectious disease threats.More

COVID-19 | Disease | Health | Therapy |

Battlefield Medicine

Dr. Tristan McClure-Begley

The Battlefield Medicine program supports military readiness in far-forward deployed settings by overcoming logistical obstacles to manufacturing and delivery of urgently needed pharmaceutical products used to treat emerging threats.More

Disease | Health | Therapy |

Bio-inspired Restoration of Aged Concrete Edifices (BRACE)

Dr. Matthew Pava

The Bio-inspired Restoration of Aged Concrete Edifices (BRACE) program aims to prolong the serviceability of Department of Defense (DoD) structures and airfield pavements by integrating a self-repair capability into existing concrete. More

Bio-systems | Design | Materials | Restoration | Syn-Bio |

Bioelectronics for Tissue Regeneration (BETR)

Dr. Paul Sheehan

The Bioelectronics for Tissue Regeneration (BETR) program will develop technology aimed at speeding warfighter recovery, and thus resilience, by directly intervening in wound healing. To do this, researchers will build an adaptive system that uses actuators to biochemically or biophysically stimulate tissue, sensors to track the body's complex response to that stimulation, and adaptive learning algorithms to integrate sensor data and dictate intervention to the actuators.More

Artificial Intelligence | Health | Injury | Med-Devices | Sensors |

Biological Control

Dr. Paul Sheehan

The Biological Control program seeks to support a wide range of potential Department of Defense (DoD) applications by establishing design and control principles that lead to reliable performance in biological systems. Leveraging technologies developed under this program will enable consistent operation of systems that combat biological threats; speed healing after physical trauma; and support military readiness by complementing the body's natural defenses against emerging diseases.More

Bio-complexity | Fundamentals | Math | Syn-Bio |

Biostasis

Dr. Tristan McClure-Begley

The Biostasis program aims to extend the time for lifesaving medical treatment, often referred to as "the Golden Hour," following traumatic injury or acute infection, thus increasing survivability for military personnel operating in far-forward conditions with limited access to medical professionals or trauma centers. To do so, Biostasis is developing novel chemical biology approaches that reversibly and controllably slow biological systems without cold-chain to stabilize and protect their functional capacity until medical intervention is possible.More

Chemistry | Health | Injury | Logistics | Therapy |

Blackjack

Mr. Stephen Forbes

National Security Space (NSS) assets, critical to U.S. warfighting capabilities, traditionally reside in geosynchronous orbit to deliver persistent overhead access to any point on the globe. In the increasingly contested space environment, these exquisite, costly, and monolithic systems have become vulnerable targets that would take years to replace if degraded or destroyed. DARPA's Blackjack program aims to develop and demonstrate the critical elements for a global high-speed network in low Earth orbit (LEO) that provides the Department of Defense with highly connected, resilient, and persistent coverage.More

A2/AD | Cost | Launch | Resilience | Space |

Brandeis

Dr. Joshua Baron

How can society responsibly reap the benefits of big data while protecting individual privacy?More

Data | Privacy |

Bridging the Gap Plus (BG+)

CDR Jean-Paul Chretien

The Bridging the Gap Plus (BG+) program aims to develop new approaches for treating spinal cord injury by integrating injury stabilization, regenerative therapy, and functional restoration. To achieve this combinatorial approach, BG+ teams will build two systems of implantable and adaptive devices. The first system will reduce injury effects during the early phases of spinal cord injury.More

Artificial Intelligence | Injury | Neuroscience | Restoration |

Causal Exploration of Complex Operational Environments (Causal Exploration)

Dr. Joshua Elliott

Over the last 15 years, the U.S. military has increasingly been called upon to face complex operational environments (OE) and diverse enemies. Such complex OEs require the actions of U.S. forces and host-nation or coalition partners to be based on a common holistic understanding of the OE (e.g., governments, population groups, security forces, and violent non-state actors) and, in particular, the causal dynamics that can manifest as unanticipated and often counter-intuitive outcomes.More

Analytics | BMC2 | Forecasting |

Civil Sanctuary

Dr. William Corvey

Social media platforms have the potential to be a great democratizing force, allowing individuals to participate in the free and productive sharing of ideas at a scale never before encountered in human history. During emergency situations and times of turmoil, these platforms can provide a crucial forum for discussing time-sensitive, potentially life-saving information. During Department of Defense (DoD) Humanitarian Assistance and Disaster Response (HA/DR) operations, relief efforts would benefit from a stable and constructive information environment that naturally facilitates informative dialogue. More

Analytics | Artificial Intelligence | Language | Stabilization |

Coded Visibility

Dr. Rohith Chandrasekar

Current obscurants are common military tools used to protect warfighters from detection by adversary's vision and sensors. However, despite decades of development, obscurants have significant limitations: (1) they simultaneously degrade the visual capability of friendly forces in addition to adversary forces; (2) once deployed, their performance is fixed and cannot be tuned in real time; and (3) they pose a serious health risk, requiring the use of respirators.More

EM Waves | Fundamentals | Imagery | Materials | Microstructures |

Common Heterogeneous Integration and IP Reuse Strategies (CHIPS)

Dr. Gordon Keeler

The explosive growth in mobile and telecommunication markets has pushed the semiconductor industry toward integration of digital, analog, and mixed-signal blocks into system-on-chip (SoC) solutions. Advanced silicon (Si) complementary metal oxide semiconductor (CMOS) technology has enabled this integration, but has also led to a rise in costs associated with design and processing.More

Electronics | Integration | Microchips | Microsystems | SWAP |

Communicating with Computers (CwC)

Dr. Bruce Draper

The Communicating with Computers (CwC) program aims to enable symmetric communication between people and computers in which machines are not merely receivers of instructions but collaborators, able to harness a full range of natural modes including language, gesture and facial or other expressions. For the purposes of the CwC program, communication is understood to be the sharing of complex ideas in collaborative contexts. Complex ideas are assumed to be built from a relatively small set of elementary ideas, and language is thought to specify such complex ideas—but not completely, because language is ambiguous and depends in part on context, which can augment language and improve the specification of complex ideas.More

Artificial Intelligence | Autonomy | Data |

Competency-Aware Machine Learning (CAML)

Dr. Lael Rudd

In order to transform machine learning systems from tools into partners, users need to trust their machine counterpart. One component to building a trusted relationship is knowledge of a partner's competence (an accurate insight into a partner's skills, experience, and reliability in dynamic environments). While state-of-the-art machine learning systems can perform well when their behaviors are applied in contexts similar to their learning experiences, they are unable to communicate their task strategies, the completeness of their training relative to a given task, the factors that may influence their actions, or their likelihood to succeed under specific conditions.More

Adaptability | Algorithms | Artificial Intelligence | Autonomy | ML | Trust |

Computable Models (COMP Mods)

Lt. Col. C. David Lewis, USAF

Accurate multi-physics simulation codes are essential for understanding the behavior of complex DoD systems, but they are generally not available from the commercial sector and have to be custom built. Current approaches to building simulation codes scale poorly with the number of interacting physics involved and often introduce inaccuracies that are difficult to trace and quantify. In addition, most of these DoD systems are test limited, and "big data" methods cannot be used.More

Algorithms | Complexity | Math | Programming |

Computational Cultural Understanding (CCU)

Dr. William Corvey

The U.S. Government and its agencies, including the Department of Defense (DoD), operate globally and are in constant contact with diverse cultures. Communicative understanding, not simply of local languages, but also of social customs and cultural backgrounds, lies at the heart of Civil Affairs and Military Information Support Operations activities, which together comprise the vast majority of U.S. counterinsurgency and stabilization efforts. More

Adaptability | Analytics | Artificial Intelligence | Language | ML |

Computers and Humans Exploring Software Security (CHESS)

Mr. William Martin

The Department of Defense (DoD) maintains information systems that depend on Commercial off-the-shelf (COTS) software, Government off-the-shelf (GOTS) software, and Free and open source (FOSS) software. Securing this diverse technology base requires highly skilled hackers who reason about the functionality of software and identify novel vulnerabilities.More

Automation | Complexity | Countermeasures | Cyber | Interface |

Configuration Security (ConSec)

Mr. John-Francis Mergen

The growth of the internet-of-things (IoT) and network-connected composed systems (e.g., aircraft, critical-infrastructure, etc.) has led to unprecedented technical diversity in deployed systems. From consumer IoT devices developed with minimal built-in security, which are often co-opted by malware to launch large distributed denial of service (DDoS) attacks on internet infrastructure, to remote attacks on Industrial Control System (ICS) devices, these newly connected, composed systems provide a vast attack surface. While the diversity of functionality and the scope of what can now be connected, monitored, and controlled over the Internet has increased dramatically, economies of scale have decreased platform diversity.More

Automation | Cyber | Systems |

Consortium for Execution of Rendezvous and Servicing Operations (CONFERS)

Ms. Ana Saplan

Recent technological advances have made the longstanding dream of on-orbit robotic servicing of satellites a near-term possibility. The potential advantages of that unprecedented capability are enormous. Instead of designing their satellites to accommodate the harsh reality that, once launched, their investments could never be repaired or upgraded, satellite owners could use robotic vehicles to physically inspect, assist, and modify their on-orbit assets. That could significantly lower construction and deployment costs while dramatically extending satellite utility, resilience, and reliability.More

Policy | Robotics | Satellites | Space |

COnstructive Machine-learning Battles with Adversary Tactics (COMBAT)

Dr. Paul Zablocky

Currently, Army force-on-force war games employ Red Team (adversary) operators who rely upon long-established techniques, tactics, procedures, and conventional force employment against their Blue opponent (U.S. Forces). COMBAT aims to develop artificial intelligence (AI) algorithms to generate models of Red Force brigade behaviors that challenge and adapt to Blue Forces in simulation experiments.More

Algorithms | Artificial Intelligence | Autonomy |

Context Reasoning for Autonomous Teaming (CREATE)

Mr. Aaron Kofford

CREATE aims to explore the utility of artificial intelligence (AI) on the autonomous formation of scalable machine-to-machine teams capable of reacting to and learning from unexpected missions in the absence of centralized communication and control. CREATE seeks to develop the theoretical foundations of autonomous AI teaming to enable a system of heterogeneous, contextually-aware agents to act in a decentralized manner and satisfy multiple, simultaneous and unplanned missions goals.More

Algorithms | Artificial Intelligence | Autonomy |

Control of Revolutionary Aircraft with Novel Effectors (CRANE)

Dr. Alexander M. G. Walan

The Control of Revolutionary Aircraft with Novel Effectors (CRANE) program aims to design, build, and flight test a novel X-plane that incorporates Active Flow Control (AFC) as a primary design consideration. Crane seeks to optimize the benefits of active flow control by maturing technologies and design tools, and incorporating them early in the design process.More

Air |

CONverged Collaborative Elements for RF Task Operations (CONCERTO)

Dr. Kevin Rudd

Dominance of the radio frequency (RF) spectrum is critical to successful U.S. military operations. Today, we do this using discrete radar, electronic warfare (EW), and communication payloads that are separately designed, procured, and integrated on platforms. These payloads typically use dedicated apertures, are realized with tightly coupled hardware and software, and are not well-coordinated in their use of spectrum.More

Communications | EW | ISR | SWAP | Unmanned |

Cooperative Secure Learning (CSL)

Dr. Joshua Baron

Machine Learning (ML) requires vast amounts of data, but often the data sets that enrich the models are owned by different parties and protected by privacy, security, trade secrets, or regulatory requirements. Likewise, the applied ML models (e.g., classifiers) are often owned by different parties and may be proprietary, requiring stringent protection to reduce the threat of exposure for the input data and modeling results. Due to these limitations, organizations in the government and private sector are unable to cooperate fully in model training and development to gain the best performance of ML systems.More

Artificial Intelligence | Data | Privacy |

Cornucopia

Dr. Molly Jahn

Cornucopia seeks to enable deployable, on-demand production of appetizing, microbial-origin food starting from water, air, and electricity with minimal to no supplementation. More

Bio-systems | Complexity | Logistics | Resilience | Syn-Bio |

Cross-Domain Maritime Surveillance and Targeting (CDMaST)

Mr. Aaron Kofford

The Cross-Domain Maritime Surveillance and Targeting (CDMaST) program seeks to identify and implement architectures consisting of novel combinations of manned and unmanned systems to deny ocean environments to adversaries as a means of projecting power.More

Decentralization | Maritime | Resilience | Systems | Tech-Foundations |

Cyber Assured Systems Engineering (CASE)

Mr. William Martin

Embedded computing systems are ubiquitous in critical infrastructure, vehicles, smart devices, and military systems. Conventional wisdom once held that cyberattacks against embedded systems were not a concern since they seldom had traditional networking connections on which an attack could occur. However, attackers have learned to bridge air gaps that surround the most sensitive embedded systems, and network connectivity is now being extended to even the most remote of embedded systems.More

Cyber | Formal | Trust |

Cyber-Hunting at Scale (CHASE)

Mr. Tejas Patel

Networks within the United States and abroad face increasingly broad-spectrum cyber threats from numerous actors and novel attack vectors. Malicious activity also crosscuts organizational boundaries, as nefarious actors use networks with less protection to pivot into networks containing key assets. Detection of these threats requires adjustments to network and host sensors at machine speed. Additionally, the data required to detect these threats may be distributed across devices and networks. In all of these cases, the threat actors are using technology to perpetrate their attacks and hide their activities and movement, both physical and virtual, inside DoD, commercial, and Internet Access Provider (IAP) networks.More

Analytics | Cyber | Data |

Data Protection in Virtual Environments (DPRIVE)

Dr. Tom Rondeau

The safety and security of critical information – whether it is sensitive intellectual property (IP), financial information, personally identifiable information (PII), intelligence insight, or beyond – is of vital importance. Current methods protect data as it is transmitted across a network, at rest, or while in storage. Processing or computing on this data, however, requires that it is first decrypted, exposing it to numerous vulnerabilities and threats. Fully homomorphic encryption (FHE) offers a solution to this challenge. FHE enables computation on encrypted data, or ciphertext, to keep data protected at all times. The benefits of FHE are significant, from enabling the use of untrusted networks to enhancing data privacy. More

Data | Processing | Security |

Data-Driven Discovery of Models (D3M)

Dr. Joshua Elliott

Understanding the complex and increasingly data-intensive world around us relies on the construction of robust empirical models, i.e., representations of real, complex systems that enable decision makers to predict behaviors and answer "what-if" questions. Today, construction of complex empirical models is largely a manual process requiring a team of subject matter experts and data scientists.More

Analytics | Automation | Data |

Demonstration Rocket for Agile Cislunar Operations (DRACO)

Maj. Nathan Greiner, USAF, Dr. Tabitha Dodson

The space domain is essential to modern commerce, scientific discovery, and national defense. Maintaining space domain awareness in cislunar space – the volume of space between the Earth and the Moon – will require a leap-ahead in propulsion technology.More

Space |

Detect It with Gene Editing Technologies (DIGET)

CDR Jean-Paul Chretien

The DoD requires timely and comprehensive threat detection to support overall readiness, counter the spread of disease, and promote stabilization missions. State of the art diagnostic and biosurveillance systems are unable to keep pace with disease outbreaks and fail to support decision-making at the time and place of need. The “Detect It with Gene Editing Technologies” (DIGET) program aims to leverage advances in gene editing technologies to develop field-forward diagnostic and biosurveillance technologies that enable detection of any threat, anytime, anywhere.More

COVID-19 | Disease | Health | Med-Devices | Stabilization | Syn-Bio |

Digital RF Battlespace Emulator (DRBE)

Mr. John Davies

The Digital RF Battlespace Emulator (DRBE) program aims to create the world’s first, large-scale, virtual radio frequency (RF) environment for developing, training, and testing advanced RF systems, such as radar and electronic warfare (EW) systems. The target DRBE environment will enable numerous RF systems to interact with each other in a fully closed-loop RF arena, replicating dense, responsive, real-world RF environments.More

Artificial Intelligence | Electronics | EW | Microsystems | Systems |

Direct On-Chip Digital Optical Synthesizer (DODOS)

Dr. Gordon Keeler

The Direct On-Chip Digital Optical Synthesizer (DODOS) program seeks to create a technological revolution in optical frequency control analogous to the disruptive advances in microwave frequency control in the 1940s. That early development ushered in a new era for microwave technology, transformed modern warfare, and has since been enabling a multitude of Department of Defense (DoD) and civilian capabilities, including radar, navigation technologies, and satellite and terrestrial communications. Extending frequency control to the optical regime is anticipated to greatly extend the technology base for the next generation of warfighter and other capabilities.More

Communications | Electronics | Integration | Microchips | Photonics | Sensors | Spectroscopy |

Domain-Specific System on Chip (DSSoC)

Dr. Thomas Kazior

The general-purpose computer has remained the dominant computing architecture for the last 50 years, driven largely by the relentless pace of Moore's Law. As this trajectory shows signs of slowing, however, it has become increasingly more challenging to achieve performance gains from generalized hardware, setting the stage for a resurgence in specialized architectures. Today's specialized, application-specific integrated circuits (ASICs) — hardware customized for a specific application — offer limited flexibility and are costly to design, fabricate, and program.More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing | Materials | Microchips | Microsystems | Tech-Foundations |

Driven and Nonequilibrium Quantum Systems (DRINQS)

Dr. Tatjana Curcic

DRINQS is a fundamental science program that aims to investigate a recent paradigm shift in quantum research, which maintains that periodically driving a system out of equilibrium may increase the length of time that its quantum state endures. DRINQS aims to investigate this phenomenon and demonstrate significant gains over conventional states in timekeeping, field sensing, and information processing for use in national security applications.More

Materials | PNT |

Dynamic Network Adaptation for Mission Optimization (DyNAMO)

Mr. Aaron Kofford

The Dynamic Network Adaptation for Mission Optimization (DyNAMO) program is developing and testing technologies that enable adaptive, mission-responsive networking among diverse platforms in contested environments.More

Air | Communications | Networking |

Dynamic Range-enhanced Electronics and Materials (DREaM)

Dr. Thomas Kazior

Over the past decade, DARPA's investments in the advancement of Gallium Nitride (GaN) technology have helped enable the delivery of high power radio frequency (RF) signals at higher frequencies, bandwidths, and efficiencies. Today, however, a growing number of commercial and military components – from everyday smartphones to RF jammers – are generating a vast amount of RF signals, which is creating an increasingly crowded electromagnetic environment and a need to utilize higher operating frequencies – moving up to millimeter wave (mmW) frequencies. To operate in this complex spectrum environment with large signal-to-noise ratios, next-generation mmW RF systems will require high dynamic range.More

Complexity | Materials | Microchips | Spectrum |

Electrical Prescriptions (ElectRx)

Dr. Gopal Sarma

The Electrical Prescriptions (ElectRx) program aims to support military operational readiness by reducing the time to treatment, logistical challenges, and potential off-target effects associated with traditional medical interventions for a wide range of physical and mental health conditions commonly faced by our warfighters. ElectRx seeks to deliver non-pharmacological treatments for pain, general inflammation, post-traumatic stress, severe anxiety, and trauma that employ precise, closed-loop, non-invasive modulation of the patient's peripheral nervous system.More

Health | Injury | Med-Devices | Neuroscience | Restoration |

Enhanced Attribution

Ms. Allison Kline

Malicious actors in cyberspace currently operate with little fear of being caught due to the fact that it is extremely difficult, in some cases perhaps even impossible, to reliably and confidently attribute actions in cyberspace to individuals. The reason cyber attribution is difficult stems at least in part from a lack of end-to-end accountability in the current Internet infrastructure.More

Analytics | Cyber | Data |

Enhanced Night Vision in Eyeglass Form (ENVision)

Dr. Rohith Chandrasekar

Despite decades of development, current night vision (NV) systems are bulky and heavy, resulting in a large torque on the wearer's neck. This torque greatly limits the wearer's agility and often leads to chronic injury over prolonged use. Additionally, these systems provide the wearer with a narrow field of view (FOV) and generally have limited spectral access to the near-infrared (NIR), greatly limiting situational awareness. More

Electronics | EM Waves | Materials | Microstructures | SWAP |

Enhancing Design for Graceful Extensibility (EDGE)

Dr. Bartlett Russell

The objective of the EDGE program is to develop the tools necessary to create, measure, and test Human Machine Interfaces (HMI) that provide enough situational awareness (SA) of a system's processes and status in addition to its operational environment so the operator can adapt the system in off-nominal situations. EDGE seeks design capabilities that will be fast, quantifiable, and repeatable enough for effective HMI concept design, development, and testing to be integrated into the larger systems design and development process. More

Automation | Autonomy | Cognitive Science | Complexity | Design | Unmanned | Visualization |

Ensuring Consistency of Systemic Information (ECoSystemic)

Dr. Mark Flood

The Ensuring Consistency of Systemic Information (ECoSystemic) program aims to develop innovative techniques for the robust recovery of federated financial information systems. By improving the mutual consistency of federated backups along with processes for recovering a distributed system of potentially global scale, information systems facing threats or outages can promptly return to a functional and mutually consistent restored state. This resilience and consistency in federated data stores has broad applicability in both military and commercial domains.More

Analytics | Data | Resilience |

Environmental Microbes as a BioEngineering Resource (EMBER)

Dr. Linda Chrisey

The Environmental Microbes as a BioEngineering Resource (EMBER) program will develop a biotechnology-based separation and purification strategy for Rare Earth Elements (REEs) from under-utilized domestic sources such as phosphate mine waste, acid mine drainage, and electronics recycling processes.More

Bio-systems | Chemistry | Manufacturing | Materials | Syn-Bio |

Epigenetic CHaracterization and Observation (ECHO)

Dr. Eric Van Gieson

The Epigenetic CHaracterization and Observation (ECHO) program aims to diminish the threat posed by weapons of mass destruction (WMD). To do this, the program is building a man-portable device that analyzes an individual's epigenetic "fingerprint" to potentially reveal a detailed history of that individual's exposure to WMD or their precursors. DARPA envisions that the same technology could provide rapid diagnostics for troops who may have been exposed to threat agents or who may be suffering from infections, providing a timely signal to apply effective medical countermeasures.More

Analytics | CBRN | COVID-19 | Med-Devices | Sensors |

Explainable Artificial Intelligence (XAI)

Dr. Matt Turek

Dramatic success in machine learning has led to a torrent of Artificial Intelligence (AI) applications. Continued advances promise to produce autonomous systems that will perceive, learn, decide, and act on their own. However, the effectiveness of these systems is limited by the machine's current inability to explain their decisions and actions to human users (Figure 1). The Department of Defense (DoD) is facing challenges that demand more intelligent, autonomous, and symbiotic systems. Explainable AI—especially explainable machine learning—will be essential if future warfighters are to understand, appropriately trust, and effectively manage an emerging generation of artificially intelligent machine partners.More

Analytics | Artificial Intelligence | Autonomy | Data | Interface | Programming | Trust |

Extreme Optics and Imaging (EXTREME)

Dr. Rohith Chandrasekar

The goal of the EXTREME Program is to develop new optical components, devices, systems, architectures and design tools using Engineered Optical Materials (EnMats) to enable new functionality and/or vastly improve size, weight, and power characteristics of traditional optical systems. EnMats are broadly defined to include, but are not limited to, metamaterials (both metallic and dielectric), scattering surfaces and volumes, holographic structures, and diffractive elements.More

Complexity | EM Waves | Imagery | Materials | Metamaterials | Photonics |

Fast Event-based Neuromorphic Camera and Electronics (FENCE)

Dr. Whitney Mason

Event-based imagers are an emerging class of sensors with significant demonstrated advantages relative to traditional cameras. Because they operate asynchronously and only transmit data from pixels that have changed, they have been shown to produce over 100x less data in sparse scenes relative to traditional focal plane arrays (FPAs). This leads directly to 100x lower latency at 100x lower power. Despite their inherent advantages, existing event-based cameras are not currently compatible with Department of Defense (DoD) applications as DoD scenarios are highly cluttered and dynamic. More

Algorithms | Electronics | Imagery | Sensors |

Fast Network Interface Cards (FastNICs)

Mr. John-Francis Mergen

Today's network subsystems are a major performance bottleneck on the paths that interconnect multiprocessor servers. In comparison with processing speeds, parallelization, and storage speed-ups, the capacity of network links has relatively worsened over time, and to a dramatic extent. This bottleneck has remained unaddressed due to commercial incentives focused on incremental technology advances across multiple, independent market siloes in network and server technology. This has made network interface cards (NICs), which bridge the network/server boundary, an afterthought in both technology marketplaces.More

Networking | Processing |

Fieldable Solutions for Hemorrhage with bio-Artificial Resuscitation Products (FSHARP)

CDR Jean-Paul Chretien

In both military and civilian settings, hemorrhage is the leading cause of survivable, traumatic pre-hospital death. Whole blood is considered the optimal resuscitation fluid for traumatic hemorrhage in tactical combat casualty care, but the cold-chain requirement causes logistical difficulties for far-forward units. To address this challenge, the Fieldable Solutions for Hemorrhage with bio-Artificial Resuscitation Products (FSHARP) program will develop a deployable, shelf-stable, universal whole blood substitute as a hemorrhage countermeasure to sustain injured warfighters in austere, pre-hospital settings. More

Bio-systems | Health | Injury | Stabilization | Syn-Bio |

Focal arrays for Curved Infrared Imagers (FOCII)

Dr. Whitney Mason

Nearly all military-fielded imaging systems contain detector arrays fabricated using planar processes developed for electronic integrated circuits, resulting in the need to use large and complex optics to properly bring imaged objects into focus. Recent industry-led advancements have resulted in modestly curved, small-area, visible-light image sensors. The Focal arrays for Curved Infrared Imagers (FOCII) program plans to build upon the visible sensor advancements from industry by extending this capability towards large format cryogenically cooled infrared imagers with extreme curvatures to vastly improve performance while reducing the weight, volume, and cost of optics.More

Imagery | Materials | Sensors |

Focused Pharma

Dr. Tristan McClure-Begley

Military service members experience an increased lifetime risk of neuropsychiatric conditions, such as depression, post-traumatic stress, and substance abuse. These conditions are substantially more prevalent in both the active duty population and veterans relative to civilians.More

Chemistry | Health | Restoration | Therapy |

Foundations Required for Novel Compute (FRANC)

Dr. Ali Keshavarzi

The Von Neumann architecture has significantly aided the rapid advancement of computing over the past seven decades. However, moving data between the processors and memory components of this architecture requires significant time and high-energy consumption, which constrains the computing performance and workload. Overcoming this bottleneck requires new computing architectures and devices that can significantly advance the computing performance beyond the traditional practice of transistor scaling (i.e., Moore's Law).More

Artificial Intelligence | Microsystems |

Friend or Foe

Dr. Paul Sheehan

The Friend or Foe program aims to develop biosurveillance technology that can detect bacterial pathogens as, or even before, they threaten the military and homeland. The goal of the program is to quickly determine whether an unknown bacterium is harmless or virulent by directly identifying pathogenic behavior, avoiding conventional strategies that rely on known biomarkers.More

CBRN | Countermeasures | COVID-19 | Disease | Sensors |

Fundamental Design (FUN Design)

Dr. Anne Fischer

The goal of the Fundamental Design (FUN Design) program is to determine whether we can develop or discover a new set of building blocks to describe conceptual designs. The design building blocks will capture the components' underlying physics allowing a family of nonintuitive solutions to be generated.More

Artificial Intelligence | Math | Systems | Tech-Foundations |

Gain Enhancement by Novel Impact Ionization (GENII)

Dr. Whitney Mason

Avalanche photodiodes (APD) are a prevalent device structure for a number of applications, such as laser rangefinders, optical communications, and three-dimensional imaging laser radar (LADAR) due to their internal photo-electronic signal gain. Current state-of-the-art APDs rely upon intrinsic material characteristics to produce impact ionization and resulting gain. More

Electronics | Imagery | Microsystems |

Gamebreaker

Dr. Greg Kuperman

The *Gamebreaker* program seeks to develop and apply Artificial Intelligence (AI) to existing open-world video games to quantitatively assess game balance, identify parameters that significantly contribute to balance, and explore new capabilities, tactics, and rule modifications that are most destabilizing to the game.More

Algorithms | Artificial Intelligence | Autonomy | Games |

Gamma Ray Inspection Technology (GRIT)

Dr. Mark Wrobel

The Gamma Ray Inspection Technology (GRIT) program seeks transformational approaches to achieving high-intensity, tunable, and narrow-bandwidth gamma ray production, but in a compact form factor suitable for transporting the source to where the capability is needed.More

CBRN | Countermeasures | Sensors | Spectroscopy | Spectrum |

Generating RF with Photonic Oscillators for Low Noise (GRYPHON)

Dr. Gordon Keeler

Electronic oscillators lie at the heart of virtually all microelectronic systems, generating the periodic clock signals used in digital electronics and the precise frequencies that enable radar and radio frequency (RF) communications. While an ideal oscillator provides a tone at a singular frequency, component imperfections and coupling to the environment degrade the spectral purity of real-world sources. These impairments, broadly quantified as phase noise, ultimately limit the performance of many military and commercial RF systems.More

Communications | Electronics | Integration | Microsystems | Photonics | PNT | Spectrum |

Glide Breaker

Maj. Nathan Greiner, USAF

The Glide Breaker program began in 2018 to develop and demonstrate technologies to enable defense against hypersonic systems.More

Air |

Gremlins

Lt Col Paul J. Calhoun

For decades, U.S. military air operations have relied on increasingly capable multi-function manned aircraft to execute critical combat and non-combat missions. Adversaries' abilities to detect and engage those aircraft from longer ranges have improved over time as well, however, driving up the costs for vehicle design, operation and replacement. An ability to send large numbers of small unmanned air systems (UASs) with coordinated, distributed capabilities could provide U.S. forces with improved operational flexibility at much lower cost than is possible with today's expensive, all-in-one platforms—especially if those unmanned systems could be retrieved for reuse while airborne.More

Air | Communications | Networking | Targeting |

Grounded Artificial Intelligence Language Acquisition (GAILA)

Dr. William Corvey

The past few decades have seen explosive growth in the development and training of artificial intelligence (AI) systems, which are now embedded in digital computing processes spanning several key industries.More

Artificial Intelligence | Language |

Guaranteed Architecture for Physical Security (GAPS)

Mr. Walter Weiss

Modern computing systems are incapable of creating sufficient security protections such that they can be trusted with the most sensitive data while simultaneously being exposed to untrusted data streams. In certain places, the Department of Defense (DoD) and commercial industry have adopted a series of air-gaps – or breaks between computing systems – to prevent the leakage and compromise of sensitive information.More

Data | Programming | Security | Systems |

Guaranteeing AI Robustness Against Deception (GARD)

Dr. Bruce Draper

The growing sophistication and ubiquity of machine learning (ML) components in advanced systems dramatically expands capabilities, but also increases the potential for new vulnerabilities. Current research on adversarial AI focuses on approaches where imperceptible perturbations to ML inputs could deceive an ML classifier, altering its response.More

Algorithms | Artificial Intelligence | Cyber | Trust |

Habitus

Dr. Bartlett Russell

What is opaque to outsiders is often obvious – even if implicit – to locals. Habitus aims to capture and make local knowledge available to military operators, providing them with an insider view to support decision making.More

Adaptability | Algorithms | Analytics | Artificial Intelligence | Cognitive Science | Complexity | Data | Forecasting | Interface | Language | Trust |

Hand Proprioception and Touch Interfaces (HAPTIX)

Dr. Matthew Pava

With a focus on wounded warriors and facilitating their return to military service, the Hand Proprioception and Touch Interfaces (HAPTIX) program is pursuing key technologies to enable precision control of and sensory feedback from sensor-equipped upper-limb prosthetic devices. If successful, the resulting system would provide users near-natural control of prosthetic hands and arms via bi-directional peripheral nerve implants. The program has a strong focus on technology handoff and aims to create and transition clinically relevant technology in support of wounded warriors suffering from single or multiple limb loss.More

Health | Injury | Med-Devices | Neuroscience | Restoration | Therapy |

Hardening Development Toolchains Against Emergent Execution Engines (HARDEN)

Dr. Sergey Bratus

The Department of Defense (DoD) has a critical need to deny cyber attackers the capability to execute unintended, yet robust and often unobservable computations on DoD systems and critical infrastructure systems. Empirically, modern exploitation methods rely on long chains of emergent behaviors of the target's unprotected computational abstractions, where attackers leverage one combination of abstractions to create an ephemeral state in which the next set of unprotected abstractions is exposed, until the goals of exploitation are achieved. Counterintuitively, instead of being brittle and easily disrupted, these chains are robust and portable between implementations independently created by different vendors. This phenomenon is colloquially described as "weird machines"—well-defined, robust, and abstract-able engines of emergent execution (EE) and adversarial programmability. These machines are often unintentionally programmed into the target and are merely unlocked for an attacker's use through coding flaws.More

Artificial Intelligence | Cyber |

Harnessing Autonomy for Countering Cyberadversary Systems (HACCS)

Ms. Allison Kline

Malicious actors are currently able to compromise and use with impunity large numbers of devices owned and operated by third parties. Such collections of compromised and conscripted devices, commonly referred to as botnets, are used for criminal, espionage, and computer network attack purposes (often a combination of all three). Recent examples of botnets and similar malicious code include Mirai, Hidden Cobra, WannaCry, and Petya/NotPetyaMore

Autonomy | Cyber |

HEALR

Dr. Seth Cohen

Microbial infections are a problem of particular concern to the Department of Defense (DoD). The DoD has long recognized the warfighter's outsized risk of exposure to infectious disease, including the rise of antimicrobial resistant (AMR) and multidrug resistant (MDR) pathogens that have challenged military wound care in Iraq and Afghanistan. Furthermore, the responsibility of the DoD to protect the homeland encompasses biological threat agents, including bacterial threats, for which effective countermeasures are critical.More

Chemistry | Countermeasures | Disease | Therapy |

Heterogeneous Heterostructures (H2)

Dr. Thomas Kazior

Today's state of the art (SoA) microwave and millimeter wave power amplifiers have been made possible by the creation of lateral and vertical heterojunction semiconductor devices, such as high electron mobility transistors (HEMTs) and heterojunction bipolar transistors (HBTs), respectively. To meet future mission requirements for longer range operation, wider bandwidth, and link robustness, power amplifiers with higher output power than can be achieved with today's SoA are needed. More

Electronics | Materials | Microsystems |

Hierarchical Identify Verify Exploit (HIVE)

Dr. Bryan Jacobs

Social media, sensor feeds, and scientific studies generate large amounts of valuable data. However, understanding the relationships among this data can be challenging. Graph analytics has emerged as an approach by which analysts can efficiently examine the structure of the large networks produced from these data sources and draw conclusions from the observed patterns.More

Analytics | Data | Tech-Foundations |

High power Amplifier using Vacuum electronics for Overmatch Capability (HAVOC)

The effectiveness of combat operations across all domains increasingly depends on our ability to control and exploit the electromagnetic (EM) spectrum and to deny its use to our adversaries. Below 30 GHz, the proliferation of inexpensive high-power commercial radio frequency (RF) sources has made the EM spectrum crowded and contested, challenging our spectrum dominance. The numerous tactical advantages offered by operating at higher frequencies, most notably the wide bandwidths available, is driving both commercial and DoD solid-state and vacuum electronic amplifiers into the millimeter wave (mm-wave) spectrum above 30 GHz.More

Electronics | Spectrum | SWAP |

Hunter

CDR Greg Sutton

The Hunter program seeks to develop an innovative concept for the delivery of advanced undersea payloads from extra-large unmanned underwater vehicles (XLUUVs). The Hunter program will be executed in phases. Phase 1 seeks to design and build the payload delivery device to fit inside a government-provided payload module. Phases 2 and 3 aim to support integration of the payload delivery device into the XLUUV and perform testing.More

Maritime | Unmanned |

Hybrid AI to Protect Integrity of Open Source Code (SocialCyber)

Dr. Sergey Bratus

The Department of Defense (DoD) has critical dependencies on open source software (OSS) throughout its supply chain, including operating systems, virtualization systems, and hypervisors as well as tool chains for software development. The DoD's use of OSS saves cost, increases maintainability, and attracts developer talent, but also creates an unprecedented attack surface, in which many trusted software parts and paths are exposed to hostile manipulation. Manipulators can leverage the full scope of social mechanisms and incentives that make the OSS sociotechnical ecosystem so valuable.More

Artificial Intelligence | Cyber |

Hyper-wideband Enabled RF Messaging (HERMES)

Dr. Tom Rondeau

Modern networks and platforms rely on access to the radio frequency (RF) spectrum for communications, radar sensing, command and control, time transfer, and geo-location. Electromagnetic interference, due to congestion in the spectrum or malicious jamming, can have catastrophic effects. Countering such interference is particularly important for unmanned platforms. To address this challenge, the Hyper-wideband Enabled RF Messaging (HERMES) program seeks to provide an assured link for essential communications by developing a jammer- countering capability that is orders of magnitude beyond the state-of-the-art.More

Communications | Microsystems | Spectrum |

Hypersonic Air-breathing Weapon Concept (HAWC)

Mr. Andrew Knoedler

Systems that operate at hypersonic speeds—five times the speed of sound (Mach 5) and beyond—offer the potential for military operations from longer ranges with shorter response times and enhanced effectiveness compared to current military systems. Such systems could provide significant payoff for future U.S. offensive strike operations, particularly as adversaries' capabilities advance.More

Air |

In the Moment (ITM)

Dr. Matt Turek

In the Moment (ITM) aims to support the development of algorithms that are trusted to independently make decisions in difficult domains. Military operations – such as mass casualty triage and disaster relief – require complex and rapid decision-making in dynamic situations where there is often no human consensus and no ground truth. By identifying key attributes underlying trusted human decision-making in dynamic settings and computationally representing those attributes, the ITM program seeks to generate a quantitative alignment framework for a trusted human decision-maker and an algorithm. This alignment framework will form the basis for understanding algorithm alignment with trusted humans, enable algorithms to incorporate key trusted attributes, and support the development of algorithms that can be tuned to align with specific, trusted humans. A dedicated team will provide ethical, legal, and social issues guidance, as well as consider future policy options for autonomous decision-making systems.More

Adaptability | Algorithms | Artificial Intelligence | Cognitive Science | Trust |

Influence Campaign Awareness and Sensemaking (INCAS)

Dr. Brian Kettler

The U.S. is engaged with its adversaries in an asymmetric, continual, war of weaponized influence narratives. Adversaries exploit misinformation and true information delivered via influence messaging: blogs, tweets, and other online multimedia content. Analysts require effective tools for continual sensemaking of the vast, noisy, adaptive information environment to identify adversary influence campaigns.More

Analytics | Artificial Intelligence | Cognitive Science | Language | ML | Stabilization | Visualization |

Insect Allies

Dr. Blake Bextine

The Insect Allies program is pursuing scalable, readily deployable, and generalizable countermeasures against potential natural and engineered threats to the food supply with the goals of preserving the U.S. crop system. National security can be quickly jeopardized by naturally occurring threats to the crop system, including pathogens, drought, flooding, and frost, but especially by threats introduced by state or non-state actors. Insect Allies seeks to mitigate the impact of these incursions by applying targeted therapies to mature plants with effects that are expressed at relevant timescales—namely, within a single growing season.More

Bio-complexity | Bio-systems | Countermeasures | Resilience | Syn-Bio |

Intelligent Design of Electronic Assets (IDEA)

Dr. James Wilson

Next-generation intelligent systems supporting Department of Defense (DoD) applications like artificial intelligence, autonomous vehicles, shared spectrum communication, electronic warfare, and radar require processing efficiency that is orders of magnitude beyond what is available through current commercial electronics. Reaching the performance levels required by these DoD applications however will require developing highly complex system-on-chip (SoC) platforms that leverage the most advanced integrated circuit technologies.More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing

| Materials | Microchips | Microsystems |
Tech-Foundations |

Intelligent Neural Interfaces (INI)

Dr. Kristen Jordan

The Intelligent Neural Interfaces (INI) program seeks to establish “Third-Wave” artificial intelligence methods to improve and expand the application space of next-generation neurotechnology.More

Algorithms | Artificial Intelligence | Automation |
Neuroscience |

Intent-Defined Adaptive Software (IDAS)

Mr. William Martin

Managing complexity is a central problem in software engineering. A common approach to address this challenge is concretization, in which a software engineer makes decisions based on a set of apparently or almost equivalent options to enable the resulting code to compile. Concretization makes the process of software development more controllable, allowing the engineer to define and implement an architecture, divide the development tasks into manageable parts, establish conventions to enable their integration, and integrate them into a cohesive software system.More

Automation | Programming | Systems |

INTERfering and Co-Evolving Prevention and Therapy (INTERCEPT)

Dr. Amy Jenkins

Viral pathogens pose a continuous and shifting biological threat to military readiness and national security overall in the form of infectious disease with pandemic potential. Today’s limited vaccines and other antivirals are often circumvented by quickly mutating viruses that evolve to develop resistance to treatments that are carefully formulated to act only specific strains of a virus.More

COVID-19 | Disease | Health | Therapy |

Investigating Adaptive Modal Bases for Intelligent Classification (IAMBIC)

Dr. Joe Altepeter

Recent imaging techniques inspired by the mathematics of quantum information claim to enable imaging beyond the traditional Rayleigh resolution limit.More

Imagery | Programming | Quantum | Sensors |

Invisible Headlights

Dr. Joe Altepeter

Autonomous and semi-autonomous systems need active illumination to navigate at night or underground. Switching on visible headlights or some other emitting system like lidar, however, has a significant drawback: It allows adversaries to detect a vehicle's presence, in some cases from long distances away.More

Autonomy | Imagery | Photonics | Sensors | Spectrum |

Joint University Microelectronics Program (JUMP)

Dr. Dev Palmer

Due to engineering limitations and cost constraints, the dynamics of the electronic industry are continually changing. Commercial companies increasingly recognize the need to differentiate their products through research in areas other than device scaling, such as new circuit architectures and computing algorithms.More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing | Materials | Microchips | Microsystems | Tech-Foundations |

Knowledge Management at Scale and Speed (KMASS)

Mr. Ted Senator

Organizations, including the military, store massive amounts of knowledge intended for human consumption, e.g., doctrine, policy, procedures, etc. Creating these documents, videos, and other modes is both expensive and time consuming. They are not structured or indexed to support rapid and appropriate application to particular tasks and may be inconsistent or confusing. Further, this knowledge must be augmented by local and timely knowledge appropriate to the particulars of a task, accounting for any unique context or situations. Capturing knowledge along with this context as it is created currently requires a dedicated effort on the part of the person performing the task, which often does not happen. Applying stored knowledge requires a user to know that it exists, where it exists, when it is needed and relevant, how to retrieve it, and how to locate the specifics in what typically is a multi-page document or several minute long video with audio. Applying stored knowledge may not always be possible given time constraints.More

Analytics | Artificial Intelligence | Data | ML |

Knowledge-directed Artificial Intelligence Reasoning Over Schemas (KAIROS)

Dr. William Corvey

Rapid comprehension of world events is essential for informing U.S. national security - a task that becomes more difficult as the amount of unstructured, multimedia information grows exponentially. Humans make sense of events by organizing them into narrative structures that occur frequently. These structures are abstracted into schemas, which are organized units of knowledge that represent a pattern of memory used in human cognition.More

Analytics | Artificial Intelligence | Data |

Lasers for Universal Microscale Optical Systems (LUMOS)

Dr. Gordon Keeler

Lasers have made a tremendous impact on our world – they are essential to diverse fields such as optical communications, remote sensing, manufacturing, and medicine. At the same time, photonic integrated circuits have allowed unprecedented advances in optical systems for Department of Defense (DoD) applications, including LiDAR, signal processing, chip-scale optical clocks, gyros, and data transmission. However, these two technologies today are limited by the incompatibility of the materials used to create them – silicon photonics are easy to manufacture but are poor light emitters while compound semiconductors enable efficient emitters but are difficult to scale for complex integrated circuits.More

Integration | Photonics | Processing | Quantum | Sensors |

Learning Introspective Control (LINC)

Mr. John-Francis Mergen

Control design currently aims to model the range of operating environments that are anticipated at design time. Plans can fail, however, when physical attacks, unforeseen conditions, or unanticipated use places the system outside the design envelope. Custom tailored aftermarket remedies are not commonly available and require a skilled technician to install, and modifications to existing systems through procurement channels can take months or years. The Department of Defense (DoD) systems are particularly long-lived, so ongoing adaptation would permit continual modification as missions and theaters change, providing a strategic advantage over an adversary.More

Adaptability | Artificial Intelligence | ML | Restoration | Systems |

Learning with Less Labeling (LwLL)

Dr. Bruce Draper

In supervised machine learning (ML), the ML system learns by example to recognize things, such as objects in images or speech. Humans provide these examples to ML systems during their training in the form of labeled data. With enough labeled data, we can generally build accurate pattern recognition models.More

Algorithms | Artificial Intelligence | Data |

Lifelong Learning Machines (L2M)

Mr. Ted Senator

Artificial intelligence (AI) and machine learning (ML) systems have advanced significantly in recent years. Despite a wide range of impressive results, current AI is not intelligent in the biological sense. These systems are limited to performing only those tasks for which they have been specifically programmed and trained, and are inherently subject to safety hazards when encountering situations outside them.More

Adaptability | Artificial Intelligence | Tech-Foundations |

Limits of Thermal Sensors (LOTS)

Dr. Whitney Mason

Unlike photonic sensors that exploit the photoelectric effect to enable infrared imaging at cryogenic temperatures, uncooled thermal sensors work by allowing an infrared absorbing material to be heated by incident electromagnetic radiation to produce an image. Such thermal sensing devices, also known as bolometers, have traditionally been less sensitive and slower than their cooled photonic analogs.More

Sensors | Thermal |

Living Foundries

Dr. Anne Cheever

Current and emerging Department of Defense (DoD) capabilities rely upon access to a number of critical, high-value molecules that are often prohibitively expensive, unable to be domestically sourced, and/or impossible to manufacture using traditional synthetic approaches. DARPA's Living Foundries program aims to enable adaptable, scalable, and on-demand production of such molecules by programming the fundamental metabolic processes of biological systems to generate a vast number of complex molecules that are not otherwise accessible.More

Bio-systems | Manufacturing | Syn-Bio |

LogX

Dr. Jeff Maas

The Department of Defense (DoD)'s Joint Logistics Enterprise, which spans both supply chain and logistics operations, provides the means to muster, transport, and sustain military power anywhere in the world at a high level of readiness.More

Artificial Intelligence | Data | Globalization | Logistics | Resilience |

LongShot

Lt Col Paul J. Calhoun

The objective of the LongShot program is to disrupt the paradigm of air combat operations by demonstrating an unmanned air-launched vehicle capable of employing current air-to-air weapons, significantly increasing engagement range and mission effectiveness. The program will design, fabricate, and flight test a demonstration system to prove the feasibility of the LongShot concept.More

Air | Autonomy | Countermeasures | Targeting | Unmanned |

Low Resource Languages for Emergent Incidents (LORELEI)

Dr. William Corvey

The U.S. Government operates globally and frequently encounters so-called “low-resource” languages for which no automated human language technology capability exists. Historically, development of technology for automated exploitation of foreign language materials has required protracted effort and a large data investment. Current methods can require multiple years and tens of millions of dollars per language—mostly to construct translated or transcribed corpora.More

Analytics | Artificial Intelligence | Autonomy | Data | Imagery | Language |

Machine Common Sense (MCS)

Dr. Matt Turek

Machine common sense has long been a critical—but missing—component of AI. Its absence is perhaps the most significant barrier between the narrowly focused AI applications we have today and the more general, human-like AI systems we would like to build in the future. The MCS program seeks to create the computing foundations needed to develop machine commonsense services to enable AI applications to understand new situations, monitor the reasonableness of their actions, communicate more effectively with people, and transfer learning to new domains.More

Algorithms | Artificial Intelligence | Data | Programming |

Magnetic Miniaturized and Monolithically Integrated Components (M3IC)

Dr. David K. Abe

The Magnetic Miniaturized and Monolithically Integrated Components (M3IC) program aims to integrate magnetic components onto semiconductor materials, improving the size and functionality of electromagnetic (EM) systems for communications, radar, and electronic warfare (EW). Current EM systems use magnetic components such as circulators, inductors, and isolators, but these are bulky and cannot be integrated with miniaturized electronic circuitry.More

Electronics | Integration | Materials | Spectrum | SWAP |

Make-It

Dr. Vishnu Sundaresan

Synthetic chemistry is important across countless technological areas, from medicines to energetics to advanced coatings to functional materials. While our synthetic capabilities have developed rapidly over the last century, current approaches are still slow and inefficient, with poor reproducibility and scalability and limited use of prior knowledge. Such an approach not only limits production of known materials, but also impedes discovery of better synthetic routes and completely new molecules.More

Chemistry | Complexity | COVID-19 | Data | Fundamentals | Integration |

Manta Ray

CDR Kyle Woerner

Unmanned undersea vehicles (UUVs) that operate for extended durations without the need for human-present logistic support or maintenance offer the potential for persistent operations in forward environments. Such systems could allow traditional host vessels increased freedom of operational flexibility while providing traditional servicing ports with relief of workload.More

Autonomy | Energy | Maritime | Robotics |

Materials Architectures and Characterization for Hypersonics (MACH)

Dr. William Carter

The Materials Architectures and Characterization for Hypersonics (MACH) program aims to develop and demonstrate new materials architectures for sharp, shape-stable, cooled leading edges for hypersonic vehicles. The program will investigate innovative approaches that enable revolutionary advances in the materials, design and implementation of shape-stable, high heat flux capable leading edge systems.More

Air | Manufacturing | Materials | Microsystems | Thermal |

Materials for Transduction (MATRIX)

Dr. William Carter

Transductional materials convert energy between different forms or domains, such as thermal to electrical energy, or electric field to magnetic field.More

Electronics | Materials | SWAP |

Measuring Biological Aptitude (MBA)

Dr. Eric Van Gieson

Whereas the tools and weapons that are used by our warfighters have evolved dramatically in the past few decades, the way in which the warfighter is prepared has not kept pace with those developments. The Measuring Biological Aptitude (MBA) program aims to address the need for a more capable fighting force by helping individual warfighters identify, measure, and track personalized biomarkers related to training and peak performance for specialized roles. If the program succeeds, MBA technologies will give warfighters the ability to understand the underlying biological processes that govern their performance.More

Analytics | Med-Devices | Resilience | Sensors | Training |

Measuring the Information Control Environment (MICE)

Dr. Joshua Baron

The Measuring the Information Control Environment (MICE) AI Exploration Opportunity aims to develop algorithms and prototype open-source software that measures how authoritarian regimes employ digitally repressive techniques, such as censorship, blocking, or throttling, at scale over the internet, as well as the technical capabilities used to enable such activities. More

Artificial Intelligence | Cyber |

Media Forensics (MediFor)

Dr. Matt Turek

Historically, the U.S. Government deployed and operated a variety of collection systems that provided imagery with assured integrity. In recent years however, consumer imaging technology (digital cameras, mobile phones, etc.) has become ubiquitous, allowing people the world over to take and share images and video instantaneously.More

Analytics | Imagery | Trust |

Microscale Plasma Devices (MPD) (Archived)

Many defense electronics are susceptible to radiation and high temperatures. Developing electronics that can withstand harsh conditions would expand the types of environments in which DoD electronics may be used.More

Manufacturing | Microsystems |

Military Tactical Means (MTM)

Mr. Chris Simi

The MTM program aims to develop sensors and exploitation techniques capable of performing wide-area searches to detect high-value targets. Program design will provide the ability to identify high-value adversary targets and to maintain positive chain-of-custody hand-offs.More

A2/AD | ISR | Sensors |

Millimeter Wave Digital Arrays (MIDAS)

Dr. Timothy Hancock

There is increasing interest in making broader use of the millimeter wave frequency band for communications on small mobile platforms where narrow antenna beams from small radiating apertures provide enhanced communication security. Today's millimeter wave systems, however, are not user friendly and are designed to be platform specific, lacking interoperability and are thus reserved for only the most complex platforms.More

Communications | Electronics | Mobile | Spectrum | Systems |

Millimeter Wave GaN Maturation (MGM)

Dr. Timothy Hancock

The DARPA Nitride Electronics NeXt-Generation Technology (NEXT) program had the goal of developing a revolutionary GaN transistor technology to simultaneously achieve high-speed and large voltage swing. The expected outcome of the program was that highly-scaled GaN devices would ultimately benefit the design of efficient millimeter wave power amplifiers and mixed-signal circuits. The NEXT program was successful in developing GaN transistors with deeply scaled gate lengths along with modifications to the heteroepitaxial channel material, ohmic contacts, and overall gate structure, resulting in record performance for GaN devices.More

Design | Manufacturing |

Mission-Integrated Network Control (MINC)

Dr. Mary R. Schurgot

The objective of the MINC program is to ensure that critical data finds a path to the right user at the right time in highly contested, highly dynamic communication environments using secure control of any available communication or networking resources (communications, compute, or storage capabilities). The MINC approach is designed to interoperate with a heterogeneous mix of legacy and future systems to ensure timely and reliable delivery of data that is not guaranteed today. More

Autonomy | BMC2 | Communications | Networking | Resilience |

Mobile Force Protection (MFP)

Dr. Gregory Avicola

DARPA's Mobile Force Protection (MFP) program focuses on a challenge of increasing concern to the U.S. military: thwarting the proliferation of small, unmanned aircraft systems. These systems – which include fixed- or rotary-wing aircraft and have numerous advantages such as portability, low cost, commercial availability, and easy upgradeability – pose a fast-evolving array of dangers for U.S. ground and maritime convoys.More

Air | Countermeasures | Unmanned |

Modeling Adversarial Activity (MAA)

Dr. William Corvey

The goal of the Modeling Adversarial Activity (MAA) program is to develop mathematical and computational techniques for modeling adversarial activity for the purpose of producing high-confidence indications and warnings of efforts to acquire, fabricate, proliferate, and/or deploy weapons of mass terror (WMTs). MAA assumes that an adversary's WMT activities will result in observable transactions.More

Algorithms | Analytics | Data |

Modular Optical Aperture Building Blocks (MOABB)

Dr. Gordon Keeler

Free-space optics today requires a telescope, bulk lasers with mechanical beam-steering, detectors, and electronics. The Modular Optical Aperture Building Blocks (MOABB) program seeks to design all of these components into a single integrated device. In what would be deemed as the most complex electronic-photonic circuit ever fashioned, the program's performers will work to create a wafer-scale system that is 100x smaller and lighter than conventional systems and can steer the optical beam 1,000x faster than mechanical components.More

Imagery | Integration | ISR | Photonics | Sensors |

Molecular Informatics

Dr. Anne Fischer

The Molecular Informatics program brings together a collaborative interdisciplinary community to explore completely new approaches to store and process information with molecules. Chemistry offers an untapped, rich palette of molecular diversity that may yield a vast design space to enable dense data representations and highly versatile computing concepts outside of traditional digital, logic-based approaches.More

Chemistry | Data | Fundamentals | Processing |

Morphogenic Interfaces (MINT)

Dr. Vishnu Sundaresan

The Morphogenic Interfaces (MINT) program aims to enable the development of persistent high-performance electrochemical systems by addressing the irreversible morphological degradation that occurs at the functional material's interface. The program will investigate innovative approaches to model solid/solid, solid/liquid, and solid/vapor electrochemical interfaces and apply this knowledge to create novel interface materials that can self-regulate their morphology and maintain desired charge transport function at the electrochemical interface. More

Chemistry | Energy | Materials | Math |

Multi-Azimuth Defense Fast Intercept Round Engagement System (MAD-FIRES)

Mr. Hamish Malin

Attacks by unmanned vehicles, missiles, small planes, fast in-shore attack craft and other platforms pose a perennial, evolving and potentially lethal threat to ships and other maritime vessels. The escalating risks posed by these ever-morphing threats demand that vessels have access to defensive capabilities at the leading edge of air and surface combat technologies. In particular, current close-range gun systems would greatly benefit from an ability to engage multiple and diverse targets coming from a range of directions and do so rapidly and with high precision.More

Maritime |

Multi-Domain Analytics (MDA)

Mr. Walter Weiss

The purpose of the Multi-Domain Analytics (MDA) program is to enable automated data analysis across networks at different security levels, without manually moving impracticably large amounts of data. Each network contains different sets of data, which must be correlated in order to create a comprehensive context.More

Analytics | Automation | Data | Processing |

Nascent Light-Matter Interactions (NLM)

Dr. Rohith Chandrasekar

Recent advances in our understanding of light-matter interactions, often with patterned and resonant structures, reveal nascent concepts for new interactions that may impact many applications. Examples of these novel phenomena include interactions involving active media, symmetry, non-reciprocity, and linear/nonlinear resonant coupling effects.More

EM Waves | Fundamentals | Materials | Metamaterials | Microstructures | Photonics | Quantum | Thermal |

Network Universal Persistence (Network UP)

Mr. Aaron Kofford

The Network Universal Persistence (Network UP) program seeks to develop and demonstrate radio technology that maintains network reliability through periods of frequent signal degradation that may occur during operations in multiple environments. From time to time, network outages may occur and data transmission may be challenged.More

Communications | Mobile | Networking | Resilience |

Neural Engineering System Design (NESD)

Dr. Kristen Jordan

The Neural Engineering System Design (NESD) program seeks to develop high-resolution neurotechnology capable of mitigating the effects of injury and disease on the visual and auditory systems of military personnel. In addition to creating novel hardware and algorithms, the program conducts research to understand how various forms of neural sensing and actuation might improve restorative therapeutic outcomes.More

Health | Med-Devices | Neuroscience | Restoration |

Neural Evidence Aggregation Tool (NEAT)

Dr. Greg Witkop

Since Sept. 11, 2001, more than 30,000 active duty members and veterans have taken their own lives – four times as many as those killed in post-911 military operations.1 Effective behavioral health assessment is a mission-critical capability requiring novel tools to identify and help those at risk. Current methods to detect early signs of behavioral and mental health risk factors rely on self-reporting and screening questionnaires, which cannot reliably predict suicidality. More

Cognitive Science | Health | Neuroscience |

Next-Generation Nonsurgical Neurotechnology

Dr. Gopal Sarma

The Next-Generation Nonsurgical Neurotechnology (N^3) program aims to develop high-performance, bi-directional brain-machine interfaces for able-bodied service members. Such interfaces would be enabling technology for diverse national security applications such as control of unmanned aerial vehicles and active cyber defense systems or teaming with computer systems to successfully multitask during complex military missions.More

Communications | Interface | Neuroscience |

No Manning Required Ship (NOMARS)

Dr. Gregory Avicola

The No Manning Required Ship (NOMARS) program seeks to design a ship that can operate autonomously for long durations at sea, enabling a clean-sheet ship design process that eliminates design considerations associated with crew. NOMARS focuses on exploring novel approaches to the design of the seaframe (the ship without mission systems) while accommodating representative payload size, weight, and power.More

Autonomy | Maritime | Unmanned |

Novel Orbital and Moon Manufacturing, Materials, and Mass-efficient Design (NOM4D)

Dr. William Carter

The Novel Orbital and Moon Manufacturing, Materials, and Mass-efficient Design (NOM4D, pronounced NOMAD) program aims to develop the foundations of building robust, precise structures in space or on the moon. In contrast to today's deployable structures that are optimized for ground test and launch survival, structures such as solar arrays, antennas or optics will be specifically designed for the space or lunar environment. More

Design | Manufacturing | Materials | Satellites | Space |

Nucleic acids On-demand Worldwide (NOW)

Dr. Amy Jenkins

The Nucleic acids On-demand Worldwide (NOW) program aims to develop a mobile medical countermeasure (MCM) manufacturing platform for use in stabilization and humanitarian operations to rapidly produce, formulate, and package hundreds of doses of nucleic acid therapeutics (DNA and/or RNA).More

Automation | Countermeasures | COVID-19 | Disease | Manufacturing | Stabilization |

Ocean of Things

Mr. John Waterston

DARPA's Oceans of Things program seeks to enable persistent maritime situational awareness over large ocean areas by deploying thousands of small, low-cost floats that form a distributed sensor network. Each smart float contains a suite of commercially available sensors to collect environmental data-such as sea surface temperature, sea state, and location - as well as activity data about commercial vessels, aircraft, and even maritime mammals moving through the area. The floats transmit data periodically via satellite to a cloud network for storage and real-time analysis.More

Analytics | Complexity | ISR | Maritime |

OFFensive Swarm-Enabled Tactics (OFFSET)

Mr. Joshua Parsons

DARPA's OFFensive Swarm-Enabled Tactics (OFFSET) program envisions future small-unit infantry forces using swarms comprising upwards of 250 small unmanned aircraft systems (UASs) and/or small unmanned ground systems (UGSs) to accomplish diverse missions in complex urban environments. By leveraging and combining emerging technologies in swarm autonomy and human-swarm teaming, the program seeks to enable rapid development and deployment of breakthrough capabilities.More

Air | Autonomy | Games | Ground | Interface | ISR | Robotics | Unmanned |

Open, Programmable, Secure 5G (OPS-5G)

Mr. Tejas Patel

5G is the latest in a series of evolutions in public mobile networking, with widespread coverage and access on a subscription basis. 5G networks are characterized by improved capabilities across a variety of measures, including throughputs, latencies, numbers of devices, and battery life. 5G is used to attach small special purpose devices comprising the Internet of Things (IoT) to the Internet, and the important and growing number of services provided by the World Wide Web.More

Cyber | Mobile | Networking | Security | Trust |

Operational Fires (OpFires)

Lt. Col. Joshua Stults

The goal of the Operational Fires (OpFires) program is to develop and demonstrate a novel ground-launched system enabling hypersonic boost glide weapons to penetrate modern enemy air defenses and rapidly and precisely engage critical time sensitive targets.More

Air | Ground | Munitions | Targeting |

Optimization with Noisy Intermediate-Scale Quantum devices (ONISQ)

Dr. Tatjana Curcic

The Optimization with Noisy Intermediate-Scale Quantum devices (ONISQ) program aims to exploit quantum information processing before fully fault-tolerant quantum computers are realized. This effort will pursue a hybrid concept that combines intermediate-sized quantum devices with classical systems to solve a particularly challenging set of problems known as combinatorial optimization. ONISQ seeks to demonstrate the quantitative advantage of quantum information processing by leapfrogging the performance of classical-only systems in solving optimization challenges.More

Algorithms | Logistics | Processing | Quantum |

Oversight

Dr. Lael Rudd

DARPA, the U.S. Space Force, and the Space Development Agency (SDA) are developing new satellite constellations to increase the tactical capabilities of U.S. space systems, however new methods are needed to effectively leverage them.More

Autonomy | Ground | ISR | Satellites | Targeting |

Panacea

Dr. Tristan McClure-Begley

Panacea is a fundamental research program designed to provide novel, multi-target therapeutics that address under-met physiological needs of Department of Defense operators. To do so, the program is applying a systems-pharmacology approach to address the intrinsic complexity of biological processes and unlock more of the potential drug target space in the human proteome. If it succeeds, it will yield new drugs that address some of the challenging physical demands faced by warfighters, including metabolic stress — as with prolonged exertion at high altitude — and activity-related soft tissue injury and resultant pain and inflammation.More

Bio-complexity | COVID-19 | Health | Injury |

Pandemic Prevention Platform (P3)

Dr. Amy Jenkins

The Pandemic Prevention Platform (P3) program aims to support military readiness and global stability through pursuit of novel methods to dramatically accelerate discovery, integration, pre-clinical testing, and manufacturing of medical countermeasures against infectious diseases. P3 confronts the reality that Department of Defense (DoD) personnel are not only deployed around the world for routine operations, but are often among the first responders to outbreaks of emerging or re-emerging disease with pandemic potential (e.g., Ebola). P3 aims specifically to develop a scalable, adaptable, rapid response platform capable of producing relevant numbers of doses against any known or previously unknown infectious threat within 60 days of identification of such a threat in order to keep the outbreak from escalating and decrease disruptions to the military and homeland.More

Countermeasures | COVID-19 | Disease | Health | Therapy |

Perceptually-enabled Task Guidance (PTG)

Dr. Bruce Draper

Military personnel are expected to perform an increasing number of tasks and more complex tasks than ever before. Mechanics, for example, are asked to repair more types of increasingly sophisticated machines and platforms, and Medics are asked to perform more procedures over extended periods of time.More

Algorithms | Artificial Intelligence | Data | Interface | ML | Visualization |

Performant Automation of Parallel Program Assembly (PAPPA)

Dr. Sandeep Neema

With the expected tapering of transistor density and performance scaling, future hardware performance gains must be derived from massive distributed parallelism, function specialization, and/or extreme system heterogeneity. In order to make these performance gains accessible to the Department of Defense (DoD), new programming methods are needed that enable near peak hardware performance with minimal programming effort. More

Automation | Electronics | Programming |

Persistent Aquatic Living Sensors (PALS)

Dr. Lori Adornato

The Persistent Aquatic Living Sensors (PALS) program aims to leverage biology to augment the Department of Defense's existing, hardware-based maritime monitoring capabilities. The program will tap into marine organisms' innate abilities to sense and respond to perturbations in their environments and apply those abilities to the detection, characterization, and reporting of manned or unmanned underwater vehicles ranging from small autonomous vessels to large nuclear submarines.More

Bio-complexity | Maritime | Sensors |

Personalized Protective Biosystem (PPB)

Dr. Eric Van Gieson

Chemical and biological (CB) threats have become increasingly ubiquitous and diverse. They present a risk to our stability operators in pandemic outbreak scenarios, and our warfighters serving in diverse operating environments. State-of-the-art protective equipment continues to severely limit mobility and performance of the user because of a dependence upon protective garments that are thick, heavy, and cumbersome. The Personalized Protective Biosystem (PPB) program aims to reduce protective equipment needs while increasing protection against existing and future CB threats.More

Bio-systems | CBRN | COVID-19 | Materials | Stabilization | Syn-Bio |

Phorcys

Mr. John Waterston

Phorcys seeks to enable a new form of access for military operations through coordination of containerized military capabilities distributed across available commercial vessels. More

A2/AD | Complexity | ISR | Logistics | Maritime | Resilience |

Photonics in the Package for Extreme Scalability (PIPES)

Dr. Gordon Keeler

Advances in digital microelectronics have enabled indispensable capabilities for the Department of Defense (DoD) in the fields of information processing, sensors, and communications. Increasingly, system performance in these domains is constrained not by the limits of computation at individual nodes, but by electrical data movement between individual chips.More

Integration | Microsystems | Photonics | Sensors

Posh Open Source Hardware (POSH)

Dr. James Wilson

The unrelenting progression of Moore's Law has created a steady cadence to ever-smaller transistors and more powerful chips, allowing billions of transistors to be integrated on a single system-on-chip (SoC). However, engineering productivity has not kept pace with Moore's Law, leading to prohibitive increases in development costs and team sizes for leading-edge SoC design. To help manage the complexity of SoC development, design reuse in the form of Intellectual Property (IP) modules has become the primary strategy.More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing | Materials | Microchips | Microsystems | Tech-Foundations |

Precise Robust Inertial Guidance for Munitions (PRIGM)

Dr. Benjamin Griffin

The Precise Robust Inertial Guidance for Munitions (PRIGM) program is developing inertial sensor technologies to enable positioning, navigation, and timing (PNT) in GPS-denied environments. PRIGM comprises two focus areas: development of a navigation-grade inertial measurement unit (NGIMU) based on micro-electromechanical systems (MEMS) platforms, and basic research of advanced inertial micro sensor (AIMS) technologies for future gun-hard, high-bandwidth, high-dynamic-range, GPS-free navigation.More

Decentralization | Microsystems | Munitions | Photonics | PNT | Sensors |

PReemptive Expression of Protective Alleles and Response Elements (PREPARE)

Dr. Amy Jenkins

Pathogens with pandemic potential, toxic chemicals, and radioactive materials all endanger public health and pose a threat to national security. Despite investment in the development of medical countermeasures (MCMs) to address these threats, many existing MCMs suffer from limited applicability, insufficient efficacy, requirements for repeat dosing, lengthy and complex manufacturing processes, and logistically burdensome storage requirements. In many cases, unique threats require unique responses, setting up a “one threat, one MCM” paradigm.More

Bio-complexity | Bio-systems | Countermeasures | COVID-19 | Disease | Health | Therapy |

PREventing EMerging Pathogenic Threats (PREEMPT)

Dr. Kristen Jordan

United States military forces deploy to remote locations around the world, often in areas where emerging infectious diseases are common. The PREventing EMerging Pathogenic Threats (PREEMPT) program seeks to preserve military readiness by protecting against the infectious disease threat; however, rather than treating people, PREEMPT targets viral pathogens within the animal reservoirs and insect vectors where many diseases originate before they spill over into humans.More

COVID-19 | Disease | Therapy |

Protected Forward Communications (PFC)

Dr. Paul Zablocky

The Protected Forward Communications (PFC) Program aims to enable small unit tactical operations to persist in electronic warfare (EW) conditions by developing an integrated communication system protecting three distinct conversations from exploitation and denial.More

A2/AD | Communications | Countermeasures | EW | Resilience |

Quantum Apertures (QA)

Dr. Jonathan Hoffman

The Quantum Apertures (QA) program aims to develop a fundamentally new way of receiving radio-frequency (RF) waveforms to improve both sensitivity and frequency agility in several application areas of interest to national security including electronic warfare, radar, and communications.More

Quantum | Sensors |

Quantum Benchmarking (QB)

Dr. Joe Altepeter

It has been credibly hypothesized that quantum computers will revolutionize multiple scientific and technical fields within the next few decades. Examples include machine learning, quantum chemistry, materials discovery, molecular simulation, many-body physics, classification, nonlinear dynamics, supply chain optimization, drug discovery, battery catalysis, genomic analysis, fluid dynamics, and protein structure prediction. More

Algorithms | Alternative Computing | Quantum |

Quantum Imaging of Vector Electromagnetic Radiation (QuIVER)

Dr. Jonathan Hoffman

The most common application of magnetic sensors is for determining the location of magnetic objects. However, a single scalar magnetometer measurement is not sufficient by itself in locating an object because many combinations of object location and magnetic strength will produce the same sensor reading. More

Quantum | Sensors |

Radio Frequency Machine Learning Systems (RFMLS)

Mr. John Davies

The goal of the Radio Frequency Machine Learning Systems (RFMLS) Program is to develop the foundations for applying modern data-driven Machine Learning (ML) to the RF Spectrum domain. These innovations form the basis of a new wave of Signal Processing technologies to address performance limitations of conventionally designed radio frequency (RF) systems such as radar, signals intelligence, electronic warfare, and communications.More

Artificial Intelligence | Communications | Spectrum |

RadioBio

Dr. Vishnu Sundaresan

The RadioBio program aims to establish whether functional signaling via electromagnetic waves between biological cells exists and, if it does, to determine what mechanisms are involved and what information is being transferred. The program seeks to determine the validity of electromagnetic biosignaling claims and, where evidence exists, understand how the structure and function of these natural “antennas” are capable of generating and receiving information in a noisy, cluttered electromagnetic environment.More

Bio-complexity | Electronics | EM Waves | Fundamentals | Sensors | Spectroscopy |

Rapid Attack Detection, Isolation and Characterization Systems (RADICS)

Mr. Walter Weiss

A substantial and prolonged disruption of electric power would have profound economic and human costs for the United States. From a defense perspective, a major power outage could hamper military mobilization and logistics and impair the capability to project force.More

Analytics | Cyber | Networking |

Rational Integrated Design of Energetics (RIDE)

Dr. Anne Fischer

Automation and artificial intelligence are revolutionizing discovery and production of functional molecules by enabling fast, reproducible experimentation and efficient property optimization. These capabilities have already made a significant impact on prevalent molecular classes, such as pharmaceuticals, but niche areas characterized by unique chemical space, limited literature precedence, and requirements for specialized experimental hardware have experienced relatively slow improvement. One such area, critical to national security, is energetics.More

Automation | Chemistry | Data | Materials |

Real Time Machine Learning (RTML)

Dr. Dev Palmer

Driven by the rapidly evolving national security threat landscape, future defense systems will need access to low size, weight, and power (SWaP) artificial intelligence (AI) solutions that can rapidly transition from idea to practice. In recent years, the ability to learn from large datasets has advanced significantly due to increases in hardware performance, advances in machine learning (ML) algorithms, and the availability of high quality open datasets.More

Artificial Intelligence | Automation | Microchips | Opportunities | Tech-Foundations |

Reconfigurable Imaging (ReImagine)

Dr. Whitney Mason

Today's imaging systems primarily perform a single or limited set of measurements due, in large part, to the underlying readout integrated circuits (ROICs), which sample the signal of interest and transfer the values off of the chip. ROICs are currently designed for a specific mode of operation and are, effectively, application specific integrated circuits (ASICs).More

Algorithms | Sensors | Systems |

Recovery of Symbolic Mathematics from Code (ReMath)

Dr. Sergey Bratus

Extracting symbolic representations of software's algorithmic parts, such as control laws for a physical process encoded in a cyber-physical system, currently requires fully manual analysis by highly specialized experts. There is no mechanized capability to translate and route relevant parts of the software to experts, such as control engineers, in an appropriate form for them to effectively analyze the mathematical expressions. In contrast, malware analysis has become considerably automated with aspects, such as provenance and behavioral characterization, gaining considerable traction in recent years.More

Artificial Intelligence | Cyber |

Recycling at the Point of Disposal (RPOD)

Dr. Vishnu Sundaresan

The Recycling at the Point of Disposal (RPOD) Disruption Opportunity (DO) will evaluate the technical feasibility to recover (separate and coextract) multiple low-volume fraction critical elements present in end-of-life electronic hardware (e-waste). Separation is defined as the extraction of various elements sequentially, and coextraction is defined as the extraction of a specified list of elements simultaneously from a feedstock containing a mixture of elements with other constituents. More

Chemistry | Rare Earth Elements | Supply Chain |

Reduction of Entropy for Probabilistic Organization (REPO)

Mr. Walter Weiss

Design and development programs in aerospace and defense often feature high complexity and long design times, which translates into long sustainment times to pay off the incurred development costs. When the inevitable technical refresh effort for such designs begins, the design intent for the equipment in question can often be problematic to divine as the original engineers and personnel are no longer available (or possess the requisite memories).More

Analytics | Automation | Electronics |

Reefense

Dr. Lori Adornato

Reefense seeks to develop self-healing, hybrid biological and engineered reef-mimicking structures to mitigate the coastal flooding, erosion and storm damage that increasingly threaten civilian and DoD infrastructure and personnel. More

Adaptability | Bio-systems | Maritime | Materials | Resilience |

Reimagining Protein Manufacturing (RPM)

Dr. Amy Jenkins

DoD access to critical proteins is currently limited by the slow response times of protein production methods. State-of-the-art (SOA) protein-based medical countermeasure (MCM) production relies on massive centralized infrastructure and complex pipelines that require lengthy cellular engineering, sufficient growth of cells for production, and intensive purification and quality control. Current response times are several months for production alone, with additional time needed for dispersing MCMs to vulnerable populations. Distributed manufacturing paradigms may transform these timelines into those relevant to DoD response, especially in denied, degraded, or disrupted operational environments. More

CBRN | Countermeasures | Disease | Manufacturing | Stabilization | Tech-Foundations |

Resilient Anonymous Communication for Everyone (RACE)

Dr. Joshua Baron

The Resilient Anonymous Communication for Everyone (RACE) program will research technologies for a distributed messaging system that can: a) exist completely within a given network, b) provide confidentiality, integrity, and availability of messaging, and c) preserve privacy to any participant in the system. Compromised system data and associated networked communications should not be helpful for compromising any additional parts of the system.More

Cyber | Privacy | Trust |

Resilient Supply-and-Demand Networks (RSDN)

Dr. Mark Flood

The Department of Defense (DoD) has a critical need to secure its sources of materiel against both intentional—including adversarial—and unintentional disruptions. Extensive global networks of private-sector vendors, commonly called "supply chains," collaborate to provide these key resources, including precursor components and materials. The Resilient Supply-and-Demand Networks (RSDN) program adopts the phrase "supply-and-demand network" (SDN) in lieu of "supply chain" to emphasize that the strategic challenges are more extensive than the logistic challenges of delivering ("supplying") materiel. More

Analytics | Data | Globalization | Resilience |

ReSource

Dr. Blake Bextine

Military logistic support has a large human cost in contested environments with no ability to create valuable materials when and where needed. DARPA's ReSource program aims to revolutionize how the military procures critical supplies on the battlefield by engineering self-contained, integrated systems that rapidly produce large quantities of supplies from feedstock collected on-site. Envisioned on-demand products include lubricants, adhesives, tactical fibers, potable water, and edible macronutrients.More

Resilience | Stabilization | SWAP | Syn-Bio |

Restoring Active Memory (RAM)

Dr. Matthew Pava

The Restoring Active Memory (RAM) program aims to mitigate the effects of traumatic brain injury (TBI) in military Service members by developing neurotechnologies to facilitate memory formation and recall in the injured brain. More than 270,000 Service members have been diagnosed with TBI since 2000. The condition frequently results in an impaired ability to retrieve memories formed prior to injury and a reduced capacity to form or retain new memories following injury. Despite the scale of the problem, few effective therapies currently exist to mitigate the long-term consequences of TBI on memory. Enabling restoration of memory function would support military readiness by providing injured personnel the option of returning to duty, and would improve quality of life for wounded veterans.More

Health | Med-Devices | Neuroscience | Restoration | Training |

ReVector

Dr. Linda Chrisey

Mosquitoes transmit pathogens that cause dengue, malaria, and other diseases that present significant risks to the readiness and resilience of military personnel, and public health more generally. The ReVector program aims to maintain the health of military personnel operating in disease-endemic regions by reducing attraction and feeding by mosquitoes.More

Disease | Health | Therapy |

Reverse Engineering of Deceptions (RED)

Dr. Matt Turek

Machine Learning (ML) techniques are susceptible to adversarial deception at training time and when deployed. Similarly, humans are susceptible to being deceived by falsified media (images, video, audio, text) or other information created with malicious intent. The consequences may be significant in both cases, and deception plays an increasingly central role in information-based attacks. More

Algorithms | Artificial Intelligence | Cyber | Trust |

Reversible Quantum Machine Learning and Simulation (RQMLS)

Dr. Joe Altepeter

Machine learning and artificial intelligence techniques are currently being applied in a diverse number of fields, including molecular simulation, many-body physics, classification, and computational optimization. However, progress in addressing these types of problems is being slowed or stopped when the problem complexity grows exponentially with problem size. Moreover, even when these complexity barriers are overcome, the impact of machine learning solutions are often mitigated by the high energy cost of training and operating the machine learning systems.More

Alternative Computing | ML | Quantum |

RNET

Dr. Richard Singer

Due to advancements in component technology, microsatellite systems are increasingly viable solutions to address earth science and remote sensing missions. For example, constellations of commercial, small, optical satellites are proliferating, supporting a variety of tasks and data applications. The ability to economically launch microsatellites on diverse launch vehicles promises advantages in rapid technology refresh, responsive space operations, and resilient (i.e., redundant) systems.More

Space |

Robotic Autonomy in Complex Environments with Resiliency (RACER)

Dr. Stuart H. Young

In complex militarily-relevant settings, robotic vehicles have not autonomously demonstrated operationally relevant speed or adaptability. The RACER program aims to make sure algorithms aren't the limiting part of the system and that autonomous combat vehicles can meet or exceed soldier driving abilities.More

Adaptability | Algorithms | Autonomy | Ground | Unmanned |

Robotic Servicing of Geosynchronous Satellites (RSGS)

Ms. Ana Saplan

Hundreds of military, government and commercial satellites reside today in geosynchronous Earth orbit (GEO) some 22,000 miles (36,000 kilometers) above the Earth—a perch ideal for providing communications, meteorology and national security services, but one so remote as to preclude inspection and diagnosis of malfunctioning components, much less upgrades or repairs. Even fully functional satellites sometimes find their working lives cut short simply because they carry obsolete payloads—a frustrating situation for owners of assets worth hundreds of millions of dollars.More

Cost | Robotics | Satellites | Space |

Robust Optical Clock Network (ROCkN)

Dr. Tatjana Curcic

Over the past two decades, precision timing in the optical domain has advanced rapidly in the laboratory and has recently surpassed – in stability and precision – the ubiquitous microwave timing techniques that make up the foundations of global precision timing in commercial and Department of Defense (DoD) domains. Optical precision timing techniques provide a means for orders of magnitude higher precision and accuracy, but, just as importantly, they enable more resilient timing capabilities with less reliance on GPS by virtue of longer holdover times and usage of optical signals that are more difficult to jam or spoof.More

EW | PNT | Quantum | Resilience |

Safe Documents (SafeDocs)

Dr. Sergey Bratus

Today, code for input data validation is typically written manually in an ad-hoc manner. For commonly-used electronic data formats, input validation is, at a minimum, a problem of scale whereby specifications of these formats comprise hundreds to thousands of pages. Input validation thus translates to thousands or more conditions to be checked against the input data before the data can be safely processed.More

Cyber | Systems | Trust |

Safe Genes

Dr. Anne Cheever

The Safe Genes program supports force protection and military health and readiness by protecting Service members from accidental or intentional misuse of genome editing technologies. Additional work will leverage advances in gene editing technology to expedite development of advanced prophylactic and therapeutic treatments against gene editors. Advances within the program will ensure the United States remains at the vanguard of the broadly accessible and rapidly progressing field of genome editing.More

Bio-complexity | Bio-systems | Countermeasures | Syn-Bio |

Science of Artificial Intelligence and Learning for Open-world Novelty (SAIL-ON)

Mr. Ted Senator

Current artificial intelligence (AI) systems excel at tasks defined by rigid rules – such as mastering the board games Go and chess with proficiency surpassing world-class human players. However, AI systems aren't very good at adapting to constantly changing conditions commonly faced by troops in the real world – from reacting to an adversary's surprise actions, to fluctuating weather, to operating in unfamiliar terrain.More

Adaptability | Algorithms | Artificial Intelligence | Automation | Autonomy | Games | Interface | ML | Resilience |

Science of Atomic Vapors for New Technologies (SAVaNT)

Dr. Tatjana Curcic

The "Science of Atomic Vapors for New Technologies" (SAVaNT) program aims to significantly advance the performance of atomic vapors as a room-temperature (RT) platform for enabling new technologies in the areas of electric field sensing and imaging, magnetic field sensing, and quantum information science (QIS).More

EM Waves | Photonics | Resilience | Sensors | Spectrum |

Sea Train

Dr. Andrew Nuss

The Sea Train program aims to demonstrate long range deployment capabilities for a distributed fleet of tactical unmanned surface vessels. The program seeks to enable extended transoceanic transit and long-range naval operations by exploiting the efficiencies of a system of connected vessels (Sea Train).More

Autonomy | Maritime |

Searchlight

Mr. John-Francis Mergen

Distributed applications are important tools for managing global enterprises as they improve both the speed and scale of decision-making, learning, and other critical functions. Virtual documents are one example of a commonly used distributed application. These provide organizations with the ability to have multiple writers and editors collaborate on document authoring in near real-time regardless of their physical locations. These critical productivity tools rely on internet-enabled, enterprise-wide communication systems to interconnect sites and create a global substrate to support their operation.More

Networking |

Secure Handhelds on Assured Resilient networks at the tactical Edge (SHARE)

Dr. Mary R. Schurgot

The security of communications and information for troops operating in tactical warfighting environments is limited. At the tactical edge, end-to-end connections on secure servers are typically unreliable, negatively impacting operations and coordination with coalition partners.More

BMC2 | ISR | Networking |

Securing Information for Encrypted Verification and Evaluation (SIEVE)

Dr. Joshua Baron

A zero-knowledge (ZK) proof is an interactive protocol between a prover and a verifier. The prover creates a statement that they want the verifier to accept, using knowledge that will remain hidden from the verifier. Recent research has substantially increased the efficiency of ZK proofs, enabling real-world use, primarily by cryptocurrencies. While useful for cryptocurrencies, the ZK proofs created are specialized for this task and do not necessarily scale for transactions that are more complex. For highly complex proof statements like those that the Department of Defense (DoD) may wish to employ, novel and more efficient approaches are needed.More

Cyber | Privacy | Trust |

Seeker Cost Transformation (SECTR)

Dr. Paul Zablocky

The Seeker Cost Transformation (SECTR) program seeks to develop novel weapon terminal sensing and guidance technologies and systems for air-launched, air-delivered weapons. SECTR technologies would enable weapons to acquire fixed and moving targets with only minimal external support; achieve high navigation accuracy in a GPS-denied environment; and be low size, weight, and cost.More

A2/AD | Autonomy | Cost | Targeting |

Semantic Forensics (SemaFor)

Dr. Matt Turek

Media generation and manipulation technologies are advancing rapidly and purely statistical detection methods are quickly becoming insufficient for identifying falsified media assets. Detection techniques that rely on statistical fingerprints can often be fooled with limited additional resources (algorithm development, data, or compute).More

Analytics | Artificial Intelligence | Trust |

Series Hybrid Electric Propulsion AiRcraft Demonstration (SHEPARD)

Mr. Steve Komadina

The Series Hybrid Electric Propulsion AiRcraft Demonstration (SHEPARD) program is an existing option to the Air Force Research Laboratory (AFRL) Great Horned Owl (GHO) contract. The SHEPARD program is based on a DARPA X-Prime construct that takes emerging technologies and burns down system-level integration risks to provide a minimum viable product to meet an urgent operational need. More

Air | Energy | Transition | Unmanned |

SIGMA+

Dr. Mark Wrobel

The SIGMA+ program aims to expand SIGMA's advance capability to detect illicit radioactive and nuclear materials by developing new sensors and networks that would alert authorities to chemical, biological, and explosives threats as well. More

Analytics | CBRN | Chemistry | COVID-19 | Sensors |

Signature Management using Operational Knowledge and Environments (SMOKE)

Mr. Tejas Patel

Networks are under persistent threat from malicious cyber actors (MCAs). In response, a growing industry of network security professionals are offering realistic, threat informed assessments of network owners' defensive posture. These assessments are performed by a team of ethical hackers (i.e., the red team) in which they assume the role of sophisticated MCAs and perform a controlled security test in collaboration with network defenders (i.e., the blue team). Red team exercises are designed to exceed simple penetration testing and emulate MCA behaviors as realistically as possible. Realistic emulation of sophisticated cyber threats in a measured exercise is very helpful for providing a comprehensive picture of network defenders' readiness. More

Cyber |

Small Satellite Sensors

Mr. Chris Simi

Dense constellations of low-earth-orbit (LEO) micro-satellites can provide new intelligence, surveillance, and reconnaissance (ISR) capabilities, which are persistent, survivable and available on-demand for tactical warfighting applications. The Small Satellite Sensors program seeks to explore new sensor concepts that are well-matched to the capabilities achievable in small satellites. More

ISR | Satellites | Sensors | Space |

Social Simulation for Evaluating Online Messaging Campaigns (SocialSim)

Dr. Brian Kettler

A rapidly increasing percentage of the world's population is connected to the global information environment. At the same time, the information environment is enabling social interactions that are radically changing how and at what rate information spreads. Both nation-states and nonstate actors have increasingly drawn upon this global information environment to promote their beliefs and further related goals.More

Complexity | Data | Fundamentals | Games | Math |

Software Defined Hardware (SDH)

Dr. Ali Keshavarzi

In modern warfare, decisions are driven by information. That information can come in the form of thousands of sensors providing information, surveillance, and reconnaissance (ISR) data; logistics/supply-chain and personnel performance measurements; or a host of other sources and formats. The ability to exploit this data to understand and predict the world around us is an asymmetric advantage for the Department of Defense (DoD).More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing | Materials | Microchips | Microsystems | Tech-Foundations |

Software Defined Radio (SDR) 4.0

Dr. Tom Rondeau

SDR and software development kits (SDK) such as GNU Radio exist as free and open source technologies that are widely used in research, industry, academia, government, and hobbyist environments to support both wireless communications research and real-world radio systems. However, even with high end multi-core x86 central processing units (CPU) there are adaptive radar, electronic warfare (EW), and communications applications that cannot be implemented onto SDR with a purely homogeneous CPU due to high latency and power consumption.More

Analytics | Automation | Data | Processing |

Space Environment Exploitation (SEE)

Lt. Col. C. David Lewis, USAF

The Space Environment Exploitation (SEE) program seeks to develop new models and sensing modalities to predict and observe the dynamics of the near-earth space environment. The SEE program explores how to go beyond magnetohydrodynamic descriptions of the magnetosphere, ionosphere, thermosphere coupled system to include wave/wave, wave/particle, and particle/particle interactions while using the latest advances in high performance computing such as GPUs and TPUs.More

Artificial Intelligence | Fundamentals | Sensors | Space |

Space-Based Adaptive Communications Node (Space-BACN)

Dr. Greg Kuperman

The goal of Space-BACN is to create a reconfigurable, multi-protocol intersatellite optical communications terminal that is low size, weight, power, and cost (SWaP-C), easy to integrate, and will have the ability to connect heterogeneous constellations that operate on different optical intersatellite link (OISL) specifications that otherwise would not be able to communicate. In simpler terms, the goal of this program is to eliminate stovepipes and "connect space," which will in turn enable the joint all-domain fight. More

Communications | Resilience | Satellites | Space | SWAP |

Squad X

Dr. Stuart H. Young

Modern military engagements increasingly take place in complex and uncertain battlefield conditions where attacks can come from multiple directions at once, and in the electromagnetic spectrum and cyber domains, as well. U.S. Army and U.S. Marine Corps dismounted infantry squads have been unable to take full advantage of some highly effective multi-domain defensive and offensive capabilities that vehicle-assigned forces currently enjoy -- in large part because many of the relevant technologies are too heavy and cumbersome for individual warfighters to carry or too difficult to use under demanding field conditions.More

Autonomy | Ground | Networking | Resilience |

Symbiotic Design for Cyber Physical Systems

Dr. Sandeep Neema

Cyber physical systems (CPS) are instrumental to current and future Department of Defense (DoD) mission needs – unmanned vehicles, weapon systems, and mission platforms are all examples of military-relevant CPS. These systems and platforms integrate cyber and physical subsystems, and the enormous complexity of the resulting CPS has made their engineering design a daunting challenge. An immediate consequence of this complexity is development cycles with prolonged timelines that challenge DoD's ability to counter emerging threats.More

Artificial Intelligence | Complexity | Integration | Interface | Opportunities | Systems |

Synergistic Discovery and Design (SD2)

Dr. Joshua Elliott

The Synergistic Discovery and Design (SD2) program aims to develop data-driven methods to accelerate scientific discovery and robust design in domains that lack complete models. Engineers regularly use high-fidelity simulations to create robust designs in complex domains such as aeronautics, automobiles, and integrated circuits. In contrast, robust design remains elusive in domains such as synthetic biology, neuro-computation, and polymer chemistry due to the lack of high-fidelity models. SD2 seeks to develop tools to enable robust design despite the lack of complete scientific models.More

Analytics | Bio-systems | Data |

System Security Integration Through Hardware and Firmware (SSITH)

Dr. Lok Yan

Electronic systems have become a critical part of daily life. Due to increased proliferation and reliance on these systems, their security is paramount to the Department of Defense (DoD), commercial industry, and beyond. Current efforts to protect electronic systems, however, rely on developing and deploying patches to the software layer, without addressing underlying vulnerabilities in the hardware. More

Cyber | Electronics | Security |

System-of-Systems Enhanced Small Unit (SESU)

Dr. Paul Zablocky

Future U.S. land forces are increasingly likely to face an adversary force that is overwhelmingly superior in size and armament with formidable anti-access/area denial (A2/AD) capabilities. SESU seeks to deliver system-of-systems (SoS) capabilities that could enable a small unit (~200-300 soldiers, corresponding materiel footprint, and limited rear-echelon support) to destroy, disrupt, degrade, and/or delay the adversary's A2/AD and maneuver capabilities in order to enable joint and coalition multi-domain operations at appropriate times and locations.More

A2/AD | BMC2 | Systems |

Systematizing Confidence in Open Research and Evidence (SCORE)

Dr. Greg Witkop

The Department of Defense (DoD) often leverages social and behavioral science (SBS) research to design plans, guide investments, assess outcomes, and build models of human social systems and behaviors as they relate to national security challenges in the human domain. However, a number of recent empirical studies and meta-analyses have revealed that many SBS results vary dramatically in terms of their ability to be independently reproduced or replicated, which could have real-world implications for DoD's plans, decisions, and models. To help address this situation, DARPA's Systematizing Confidence in Open Research and Evidence (SCORE) program aims to develop and deploy automated tools to assign "confidence scores" to different SBS research results and claims.More

Algorithms | Analytics | Automation | Data | Forecasting | Processing | Trust |

Tactical Boost Glide (TBG)

Dr. Peter Erbland, Lt. Col. Joshua Stults

Systems that operate at hypersonic speeds—five times the speed of sound (Mach 5) and beyond—offer the potential for military operations from longer ranges with shorter response times and enhanced effectiveness compared to current military systems. Such systems could provide significant payoff for future U.S. offensive strike operations, particularly as adversaries' capabilities advance.More

Air |

Tailorable Feedstock and Forming (TFF)

Dr. William Carter

The capabilities and technical specifications required for Department of Defense (DoD) platforms are constantly changing due to unanticipated circumstances, needs and emerging threats. However, complex development and design cycles and the associated high costs of structural design changes for current technologies significantly limit our ability to rapidly and affordably evolve such systems.More

Complexity | Cost | Manufacturing | Materials | Processing |

Target Recognition and Adaption in Contested Environments (TRACE)

Dr. Adam Bryant

In a target-dense environment, the adversary has the advantage of using sophisticated decoys and background traffic to degrade the effectiveness of existing automatic target recognition (ATR) solutions. Airborne strike operations against relocatable targets require that pilots fly close enough to obtain confirmatory visual identification before weapon release, putting the manned platform at extreme risk. Radar provides a means for imaging ground targets at safer and far greater standoff distances; but the false-alarm rate of both human and machine-based radar image recognition is unacceptably high. Existing ATR algorithms also require impractically large computing resources for airborne applications.
More

A2/AD | Air | Algorithms |

Targeted Neuroplasticity Training (TNT)

Dr. Matthew Pava

The Targeted Neuroplasticity Training (TNT) program supports improved, accelerated training of military personnel in multifaceted and complex tasks. The program is investigating the use of non-invasive neurotechnology in combination with training to boost the neurochemical signaling in the brain that mediates neural plasticity and facilitates long-term retention of new cognitive skills. If successful, TNT technology would apply to a wide range of defense-relevant needs, including foreign language learning, marksmanship, cryptography, target discrimination, and intelligence analysis, improving outcomes while reducing the cost and duration of the Defense Department's extensive training regimen.More

Fundamentals | Med-Devices | Neuroscience | Training |

Technologies for Mixed-mode Ultra Scaled Integrated Circuits (T-MUSIC)

Dr. James Wilson

High performance mixed-mode electronics provide the interface between analog signals in the physical world and digital signals in the information domain. The performance of mixed-mode interfaces directly affects applications ranging from the national telecommunications infrastructure to defense electromagnetic systems for sensing, communications, and electronic warfare. Current implementations of these interfaces in traditional complementary metal-oxide-semiconductor (CMOS) technologies are increasingly constrained by the limits of MOS transistor scaling.More

Electronics | Microchips | Spectrum |

Thermal Engineering using Materials Physics (TEMP)

Dr. William Carter

The Thermal Engineering using Metamaterial Physics (TEMP) Disruption Opportunity (DO) leverages recent developments in materials and physics to control the direction and wavelength of thermal transport by radiation in the visible spectrum in extreme thermal conditions. Solutions are being developed that can adaptively control the directionality of radiative heat transfer while simultaneously withstanding high-temperature oxidative or corrosive environments.More

Design | Energy | Manufacturing | Thermal |

Three Dimensional Monolithic System-on-a-Chip (3DSoC)

Dr. Jason Woo

Deployed electronic systems increasingly require advanced processing capabilities, however the time and power required to access system memory – commonly referred to as the "memory bottleneck" – takes a significant toll on their performance. Any substantial improvement in electronic system performance will require a radical reduction in memory access time and overall dynamic power of the system. The use of a monolithic three-dimensional system-on-chip (SoC) stack to integrate memory and logic is one approach that could dramatically alter the memory bottleneck challenge.More

Algorithms | Complexity | Cost | Decentralization | Electronics | Globalization | Integration | Manufacturing | Materials | Microchips | Microsystems | Tech-Foundations |

Time-Aware Machine Intelligence (TAMI)

Lt. Col. C. David Lewis, USAF

The Time-Aware Machine Intelligence (TAMI) program will develop new time-aware neural network architectures that introduce a meta-learning capability into machine learning.More

Adaptability | Algorithms | Artificial Intelligence | Cognitive Science |

Timely Information for Maritime Engagements (TIMEly)

Mr. Aaron Kofford

The undersea domain imposes well-known limits on communication and therefore the capacity to transfer the right information necessary to its intended purpose. The TIMEly program aims to develop concepts for a heterogeneous underwater network architecture that enables the vision of mosaic warfare by the contemporaneous composition of effect chains from available assets in any domain, but with an emphasis on the underwater domain in order to provide options for execution on the fly.More

Communications | Networking | Systems |

Topological Excitations in Electronics (TEE)

Dr. Anne Fischer

The Topological Excitations in Electronics program aims to demonstrate the utility of topological excitations in various applications including memory, logic, sensors, and quantum information processing. Developing the ability to design materials with new controllable functionalities is crucial for the future of the Nation's economic, energy, and defense security.More

Electronics | Fundamentals | Materials | Microstructures | Tech-Foundations |

Transformative Design (TRADES)

Dr. Anne Fischer

New manufacturing technologies such as additive manufacturing have vastly improved the ability to create shapes and material properties previously thought impossible. Generating new designs that fully exploit these properties, however, has proven extremely challenging. Conventional design technologies, representations, and algorithms are inherently constrained by outdated presumptions about material properties and manufacturing methods. As a result, today's design technologies are simply not able to bring to fruition the enormous level of physical detail and complexity made possible with cutting-edge manufacturing capabilities and materials.More

Algorithms | Artificial Intelligence | Complexity | Data | Design | Interface | Math |

Traveling-Wave Energy Enhancement Devices (TWEED)

Dr. David K. Abe

Amplification based on the synchronous interaction between an electromagnetic traveling wave and a monoenergetic stream of electrons is a well-known phenomenon in the field of vacuum electronics and commonly used in devices such as traveling-wave tubes (TWTs). Active gain through traveling wave interaction has been observed or postulated in other domains but has yet to be widely exploited.More

Electronics | EM Waves | Manufacturing | Microsystems |

Tunable Ferroelectric Nitrides (TUFEN)

Dr. Ali Keshavarzi

Scandium (Sc)-doped aluminum nitride (AlN) is a popular material for a number of device applications, including radio frequency (RF) filters, piezoelectric actuators, ultrasonic sensors, microphones, and oscillators. In addition to the advantageous piezoelectric and complementary physical properties of AlN-based materials, the relatively low synthesis temperatures make such materials particularly attractive for integration with electronics platforms when compared with other piezoelectric materials.More

Electronics | Fundamentals | Materials |

Underexplored Systems for Utility-Scale Quantum Computing (US2QC)

Dr. Joe Altepeter

It has been credibly hypothesized – but not proven – that quantum computers will have a transformative impact on a variety of scientific and technical disciplines. Two separate factors make the ultimate impact of quantum computing unclear. First, although a number of algorithms and applications for quantum computers have been suggested, in most cases a rigorous comparison to the best classical alternatives for real-world usage has not been completed. Second, it is unclear when or if a "utility-scale" quantum computer – one whose computational value exceeds its costs – can be built, particularly for applications that require fault-tolerance. More

Alternative Computing | Quantum |

Urban Reconnaissance through Supervised Autonomy (URSA)

Dr. Bartlett Russell

Urban Reconnaissance through Supervised Autonomy (URSA) is a DARPA program to enable improved techniques for rapidly discriminating hostile intent and filtering out threats in complex urban environments.More

Analytics | Autonomy | Cognitive Science | Complexity | Ground |

Verified Security and Performance Enhancement of Large Legacy Software (V-SPELLS)

Dr. Sergey Bratus

The DoD has a critical need for enhancing and replacing components of existing software with more secure and more performant code. This includes cases where a key performance or security benefit comes from moving parts of the software to new hardware, such as utilizing hardware accelerators, isolation enclaves, offload processors, and distributed computation.More

Cyber | Systems |

Wafer Scale Infrared Detectors (WIRED)

Dr. Whitney Mason

The low cost of digital imaging devices has allowed them to become ubiquitous consumer products. This low cost is made possible by leveraging a mature complementary metal oxide semiconductor (CMOS) processing infrastructure and the ability to fabricate complete focal plane arrays (FPAs) at the wafer scale. A similar trend is occurring at a smaller scale with thermal imaging technologies. Microbolometers that are sensitive in the LWIR spectrum are also manufactured at the wafer scale and the resulting cost reduction is enabling thermal imagers at consumer-grade price points.More

Imagery | Spectrum | SWAP |

Warfighter Analytics using Smartphones for Health (WASH)

Mr. Tejas Patel

Currently, understanding and assessing the readiness of the warfighter involves medical intervention with the help of advanced equipment, such as electrocardiographs (EKGs) and other specialized medical devices, that are too expensive and cumbersome to employ continuously or without supervision in non-controlled environments. On the other hand, currently 92 percent of adults in the United States own a cell phone, which could be used as the basis for continuous, passive health, and readiness assessment.More

Analytics | Artificial Intelligence | Data | Health |

Wideband Adaptive RF Protection (WARP)

Dr. Timothy Hancock

Over the last decade, wideband analog-to-digital converter (ADC) technology has improved in both bandwidth and resolution to a point that wideband RF sampling receivers are now a reality. However, wideband ADCs typically have less spur-free dynamic range as compared to their narrowband counterparts and are typically exposed to more signals simultaneously due to the wide bandwidth. Despite the advantages associated with more bandwidth, the dynamic range limitation can prevent the use of wideband receivers in multi-function applications that support wideband electromagnetic spectrum operations (EMSO).More

Adaptability |