

# A Global Collaborative Network: Government Labs, Academic Institutions, and Private Sector

U.S. Army collaboration with academia expands the Defense Department's science and technology ecosystem

BY **JAN TEGLER** - OCTOBER 17, 2019



The Army Research Laboratory is collaborating with Uber to develop a quieter rotor system for vertical takeoff and landing vehicles that could improve aeromechanical performance and advance the capabilities of unmanned aircraft systems. Such cooperation with industry is part of the Army's effort to form a global collaborative network of government labs, academic institutions, and the private sector.

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America's armed forces are under pressure. Nearly 20 years (and counting) invested in fighting a global war on terrorism has largely kept the United States safe from terrorist attacks, but the effort has taken a toll on the nation's readiness for major conflicts and significantly diminished its military edge. Great power competition is back.

While America has been engaged in the Middle East, China and Russia have transformed their militaries to counter U.S. power directly and indirectly. Targeted science and technology research along with [technological theft](#) has allowed these near-peer competitors to narrow capability gaps in some areas and perhaps equal or surpass the American military in a few.

In response, the Department of Defense (DOD) is renewing and expanding its own science and technology research efforts to gain back or widen the military's advantage in combat power across multiple domains. The quest for additive and transformational technology is being pursued aggressively within the armed forces' respective research establishments and beyond.

Outreach to gain access to knowledge and innovation is critical, and one of the prime assets America has is its unmatched network of research universities. The [U.S. Combat Capabilities Development Command's Army Research Laboratory \(ARL\)](#) and the Army Research Office (ARO) are tapping into this resource as never before, forging new, broader partnerships with academia.

ARL's Wendy Leonard said the Army is trying to "bring together the government labs, academic institutions, and the private sector to form a global collaborative network."

## OPEN CAMPUS AND OUTREACH AT ARL

Leonard is the program manager for ARL's Open Campus initiative, a framework launched in 2014 to open the laboratory's world-class facilities and research opportunities to partners from academia and private industry domestically and internationally. The basic idea behind it is to connect ARL scientists and engineers with outside researchers and research institutions, allowing them to work side by side with visiting scientists in ARL's facilities and to visit as researchers at collaborators' institutions.

Think of Open Campus as an Army portal to a global research network that allows researchers to move freely between academia, the private sector, and government laboratories, Leonard says. The network enables collaboration on basic scientific research oriented toward solving complex Army technology problems.

"I could move throughout the network whether I worked for the government at a lab like ARL or in a position at an academic institution, or if I was an entrepreneur and started my own company. We want all of these folks working together to address Army challenges. Solutions come from true partnerships, and those true partnerships are often based on proximity and trust," she said.



ARL scientists and visiting student researchers make use of Open Campus space to work out stylometry challenges to advance the potential of automated linguistic-type analysis, or stylometry, to determine authorship attribution of source code. The group, pictured in 2014 after the launch of Open Campus, are, from left to right: ARL network-science researcher Dr. Richard Harang, Drexel University guest researcher Aylin Caliskan-Islam, ARL computational linguist Dr. Clare Voss, ARL computational linguist Jeffrey Micher, and University of Maryland student and Army College Qualified Leader program participant Andrew Liu.

Mutual scientific interest and investment by ARL and research partners is central to the collaboration Open

Campus encourages. The concept serves as a connector between ARL and the wider scientific research world, but it's not a funding mechanism for research. ARL has a variety of funded and non-funded partnership arrangements including Collaborative Technology Alliances, which fund research with industry and academia in Micro Autonomous Systems and Technology, Network Science, Cognition and Neuroergonomics, and Robotics.

Educational Partnership Agreements provide the laboratory means to assist universities in extending their research capabilities in areas relevant to Army needs and provide an opportunity for students to work on degrees in programs of interest to ARL. Universities benefit by developing scientific and engineering expertise applicable to future Army needs, which also benefits the service. Students working on ARL-sponsored research receive early exposure to the lab, thereby expanding the possible talent pool for future recruitment.

Currently, ARL outsources 80 percent of its research program to academia, with more than 250 academic partners in all 50 states, and to industry through a mix of grants, cooperative agreements, other transactions authority, or contracts.

Dr. Patrice Collins, ARL's Outreach Special Program Coordinator, notes that connection between the laboratory and academia often comes about through relationships between scientists working in similar research areas.



**Professor Izabela Szlufarska and postdoctoral researcher Hongliang Zhang at the University of Wisconsin-Madison demonstrate a new mechanism for bending metal that could help guide the creation of stronger, more durable materials for military vehicles. Researchers on the project were funded by the Army Research Office.**

"A lot of times it's scientist-driven, where our scientists say, 'Hey, we have a relationship with this university and we want to continue collaboration. How can we do that?'"

Educational Partnership Agreements and cooperative agreements grow the relationships ARL has and leverage what it already knows about an institution to find out where matches can be made on collaboration for other challenges with that same university.

"There are times for the Outreach Office when it's more of a personal relationship that starts the conversation," Collins said.

The increased interaction ARL has with researchers in academia through Open Campus is also advanced by the initiative's website, which describes opportunities where researchers are looking for partners. Leonard says ARL researchers also connect with others at technical conferences and via citations of their work in outside research papers.

"That develops the push-pull at the 'bench level,'" she explained, "so that they're [ARL researchers] more open to

get a call from someone with complementary research.”

**Open Campus** fosters the placement of ARL researchers in outside organizations including universities and brings university researchers to the laboratory. At any given time, ARL typically has 10 to 15 percent of its workforce deployed to other research institutions and welcomes a similar percentage of outside researchers to the laboratory.

ARL’s multi-year investment in opening regional extensions of the laboratory has been a boon as well, according to Leonard. “We opened up ARL West in Los Angeles in April 2016 and followed that with ARL South in Austin, Texas, ARL Central in Chicago, and then in Boston in January 2018. We’re distributing our workforce so they also can be a conduit to our own ecosystem with other universities and talent.”

The **University of Maryland**, right next door to ARL’s Adelphi, Maryland home base, has partnered with the laboratory and the National Institute of Standards and Technology via Open Campus on scientific research for batteries in extreme environments for defense and biomedical applications, Leonard reports. The team has discovered a safe, water-in-salt electrolyte that could make lithium-ion batteries more thermally stable, less costly to produce, and more environmentally friendly.

“They call it a WISE battery,” Leonard said. “It stabilizes the chemistry so it allows for a high-capacity lithium ion battery but using a water base. That was previously unachievable and it came from a diverse partnership.”

Ultimately, ARL is looking for partnerships with academia that provide complementary benefits for the Army and research universities. Tangible benefits include new and funded programs and access to unique partner facilities with the added benefit of being able to leverage partner research.



**Researchers at the University of Maryland have partnered with the Army Research Laboratory on scientific research for batteries in extreme environments. The collaboration via Open Campus has resulted in discoveries that could make both lithium-ion and zinc batteries safer and more efficient.**

“For ARL, we might be able to attract private capital and have access to senior government leaders that the partner [academia] may not,” Leonard explained. “But we may see in the partner that they have funding for students and post-docs and staff and might have new equipment and supplies. We’re all looking for more and better students with research interests that address **Army issues**. From an academic partner, they’re looking for jobs after graduation for their students.”

Leonard added that there’s also the possibility to join on publications and have access to a broader intellectual base, as well as other partner discoveries. ARL may also have access to new employees in difficult-to-hire areas.

“Like cyber – everybody wants the top-notch cyber researchers. By working together when students are in their early career, they may get invested in what the Army’s concerns are and then become tied to that research challenge versus money. ARL is willing to talk to partners about their problems and provide pathways for student employment.”



ARL summer student interns Jacob Cohen, Carley Heiner, and Jared Richard conduct research in the lab’s Computational and Information Sciences Directorate, located at Aberdeen Proving Ground, Maryland. All three participated in ARL high school programs and returned as college students to further their research interests. Exposing students to the lab during their college careers expands the possible talent pool for future recruitment.

Collins agreed, adding that ARL’s Outreach Office “is looking to identify the best and brightest students to work with our lab and be developed by us in its environment while attending a diverse amount of universities.”

ARL participates in the Army’s College Qualified Leaders program, which enables undergraduate students to come to do research at ARL with scientists. The Outreach Office also has programs that allow it to bring in graduate students and recent graduates through its Cooperative Agreement mechanism. [There’s a Science Engineering Apprenticeship Program \(SEAP\) for high school students as well.](#)

## ARMY RESEARCH OFFICE: ANSWERING QUESTIONS AND BUILDING RESEARCH CAPACITY

Dr. Barton Halpern is the new director of the [Army Research Office](#), based in Raleigh-Durham, North Carolina. Appointed to the post in June, he’s learned quickly how to sum up ARO’s dual mission.

“We’re [ARO] trying to answer questions, they’re [ARL] trying to solve problems,” he said.

ARO is an element of ARL, the Army’s extramural face to university systems, Halpern explained. The laboratory identifies areas where it needs support, then informs ARO about specific research areas where it’s having difficulty solving a particular problem.

“We support them through university efforts,” Halpern added, “looking to see if we can find knowledge products that the universities can provide that will help in that area.”

The office’s second mission is to keep the Army abreast of cutting-edge research and identify new areas of scientific discovery of relevance to the Army. “We’re looking into the future, to 2040 or beyond,” Halpern said. “We’re looking at the generation after the next generation. That’s the long-range purpose we’re focused on.”

Staffed with roughly 100 government employees as well as contract support workers, ARO fulfills these dual roles

through a combination of grants and outreach by program managers deployed to universities across the United States and abroad.

The office executes ARL's Single Investigator Program (SIP), which supports 900 academic principal investigators per year on average. The program allows the Army to leverage world-class academic expertise and rapidly exploit novel scientific opportunities, and brings together many minds to investigate multiple pathways in search of scientific knowledge.

SIP grant opportunities are made known to academia through formal communications such as Broad Area Announcements and by ARO's program managers, who have close relationships with researchers at the various universities to which they deploy. The office updates its research priorities annually, highlighting the research questions the Army is most interested in pursuing.

"A continual dialogue happens with universities, researchers, and our staff," Halpern said. "We also have a number of workshops with them on a national and international basis and attend conferences."

ARO also connects with academia via [University Affiliated Research Centers](#), which include innovative small business research organizations and historically black colleges and universities with a minority-serving institution focus.

Randy Zachery, director of ARO's Information Science Directorate, explained that the office's 40 program managers (also deployed to London and Tokyo) not only have their pulse on the finger of advanced research at the universities with which they work, they can also help guide research initiatives.



**Dr. Barton H. Halpern, director of the Army Research Office, an element of the U.S. Army Combat Capabilities Development Command's Army Research Laboratory (left), and Dr. William Roper, UNC System interim president (right) formed a new partnership between the Army and individual UNC System institutions to stimulate student interest in STEM education, particularly in areas of relevance to the Department of Defense's mission. The Educational Partnership Agreement will facilitate sharing of information and resources between the Army and individual UNC institutions.**

"Our program managers are formulating new ideas and are involved in the administration of workshops that help define those problems for future direction," Zachery said. "They also influence the broader research community to get others to invest in those problems.

One of the chief missions of ARO and its program managers is to "prevent technical surprise," Zachery said. "We invest in things we don't necessarily know the outcome of."

Information sciences is a good example, he said, noting that the Army was an early investor in the discipline. "Now there's significant investment from OSD [the Office of the Secretary of Defense] in this and other military agencies. That was driven by Army investment 15 years back. We support the future technological superiority of soldiers in our Army here. Current modernization is not the primary role."

In addition to helping the Army stay at the forefront of scientific research, ARO's program managers cultivate university researchers who may work with them in the future across the office's nine scientific divisions: physical sciences, engineering sciences, information sciences, computational and information sciences, human research and engineering, sensors and electron devices, vehicle technology, and weapons and materials research.

Program managers may also help fund university purchases of equipment to pursue Army relevant research. Halpern cited an Educational Partnership Agreement with the University of North Carolina system that allows ARL and ARO staff to be adjunct to university staff. They share information and resources and facilitate new partnerships between the Army and individual UNC institutions.


"By streamlining the approval process for education partnership agreements at individual institutions, this agreement will open up collaboration opportunities and a pipeline of new ideas," said ARL Director Dr. Philip Perconti. "We will be able to get innovative coursework and research opportunities up and running more quickly and reach more students, attract better talent, and ultimately identify cutting-edge solutions to the military's challenges."

Wider military technology challenges are also pertinent to ARO. Each of the armed services has a core research budget, Halpern noted. Single Investigator grants (which can involve multiple researchers) are the means by which ARO applies its funding, but ARO may take on work for other military/government research laboratories – from the Office of Naval Research and the Air Force Office of Scientific Research to the Defense Advanced Research Projects Agency.

"We have a core budget of \$200 million per year," he said. "We also take in customer funds from other agencies where they leverage our investments. They're asking us to help execute their programs for them. We have the capacity and subject matter expertise here within ARO to assist them. We're science versus engineering. We're always looking for an applied example to an equation on the back end in research."

In regard to ARO's collaboration with academia, Zachery noted that the office and its program managers are in a constant mode of exploration on behalf of the Army.

"Our goal is to turn over every stone to look at all possibilities that may have relevance. We don't know what those new discoveries are, but we have to constantly probe to make sure we find those when they come about. They may lead to new capabilities and requirements that the warfighters and even ARL haven't thought about yet."

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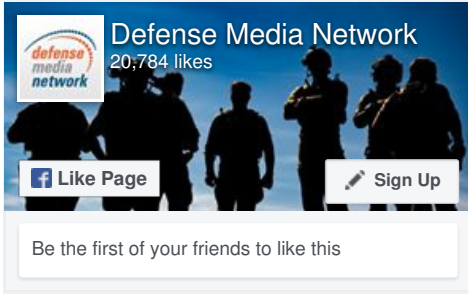
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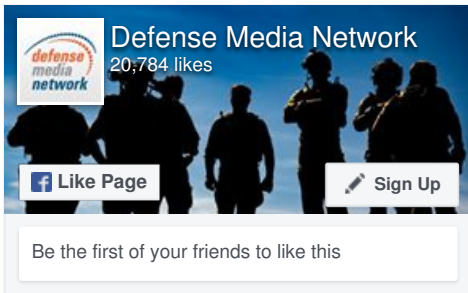
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