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Great War Remembered

100 Years Ago, America Joined the War to End All Wars,
Mobilizing a 3.7 Million-Man Army and Forever Changing the Force



Army Lab's
25 Years of
Innovation
Page 50

Research Lab Laser

By Kathleen Delano and Jenna Brady

Today's frenetic pace of technological change accelerates demand for new and better military equipment and soldier protection to ensure continued technological overmatch. The next technological advantage for the U.S. will come not from afar, but from within the Army itself. Innovation focused on the needs of the warfighter thrives at the U.S. Army Research Laboratory.

As an element of the U.S. Army Research, Development and Engineering Command, which is led by Maj. Gen. Cedric Wins, the research lab's diverse team of more than 1,500 scientists, engineers and technologists create the Army's building blocks of basic and applied research. The contributions of the lab, known as ARL, undergird the protection of America's soldiers, the defense of our citizens, our technical superiority as a global leader and standard-setter, and our military dominance.

ARL is celebrating its 25th year this year as "the nation's premier laboratory for land forces," as its slogan says. Headquartered in Adelphi, Md., ARL was formed in 1992 by the merger of eight Army laboratories.

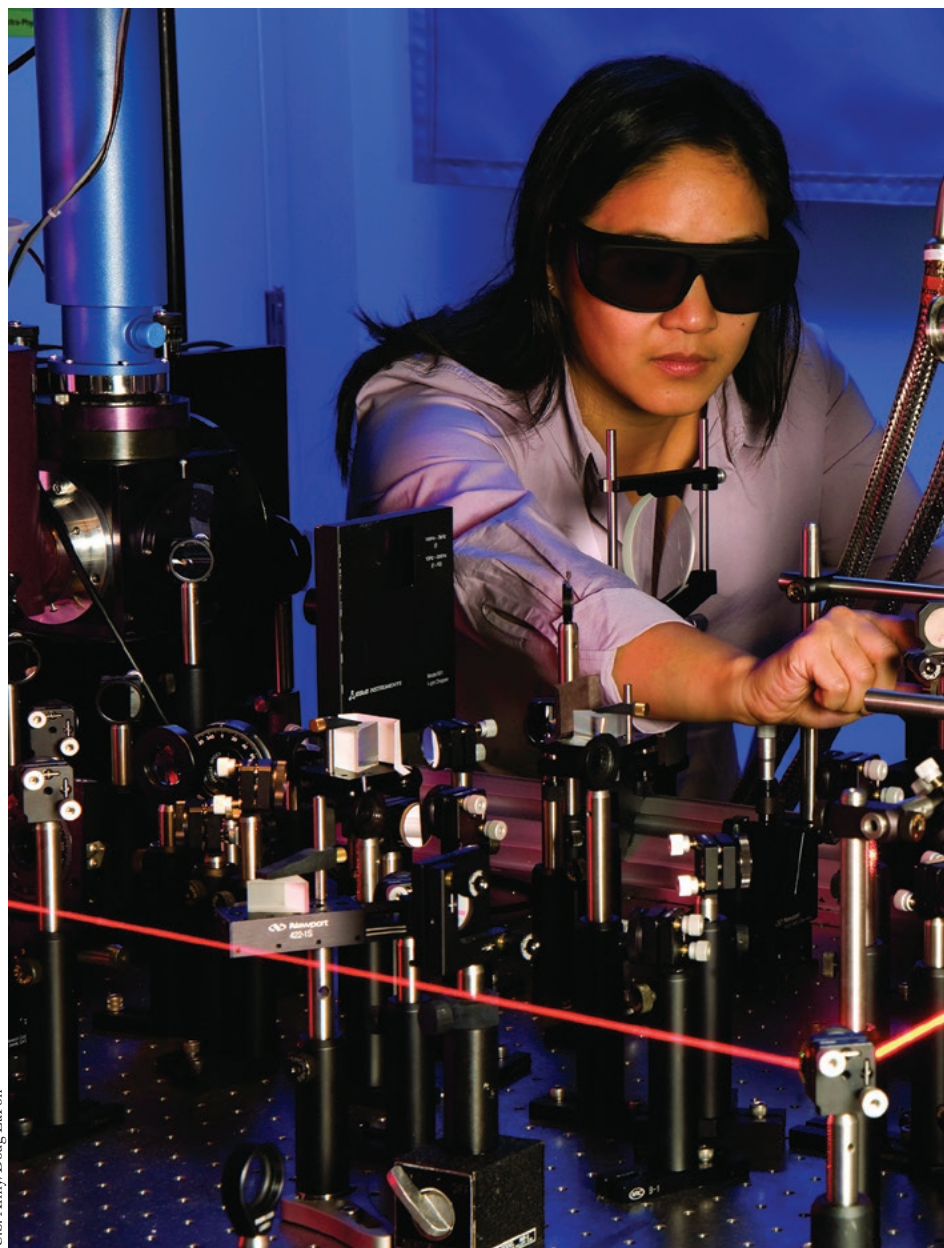
Under the leadership of acting director Philip Perconti, ARL provides the raw materials of basic research to discover, innovate and transition science and technology to ensure dominant strategic land power.

"As the Army's corporate research laboratory, ARL is always focused on the future," Perconti said. "We're excited to embark on a new era of discovery, invention and collaboration with government, universities and private-sector partnerships that will continue to drive our success for the next 25 years and beyond."

Nine Essential Research Areas

To enable the Army to pursue its Army Warfighting Concept, ARL focuses on nine essential research areas: discovery, artificial intelligence and machine learning, tactical unit energy independence, distributed and cooperative engagements in contested environments, science for manufacturing at the point of need, accelerated learning for a ready and responsive force, manipulating physics of failure for robust performance of materials, human agent teaming, and cyber and electromagnetic technologies for complex environments.

ARL organizes its work into eight technical work science and



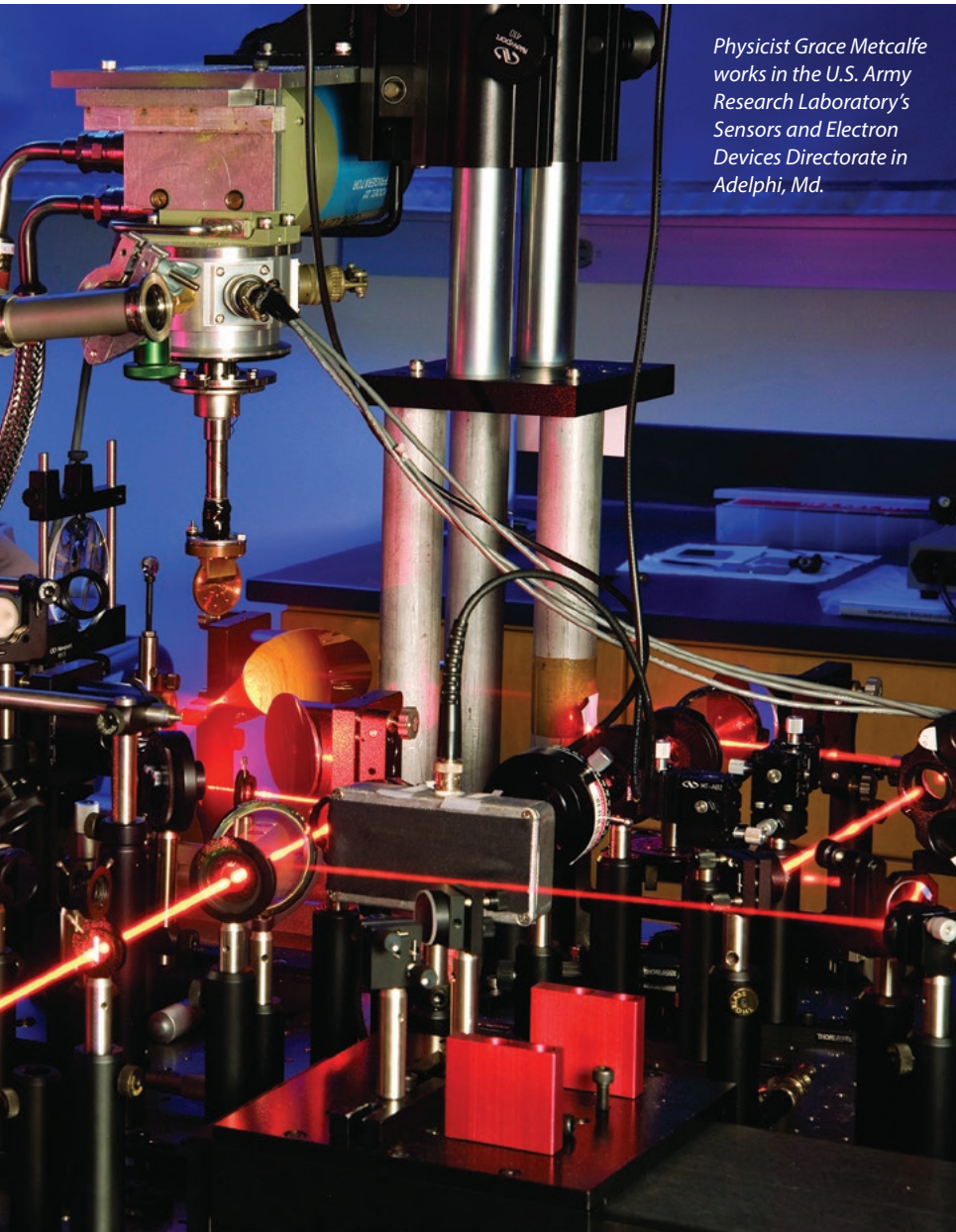
U.S. Army/Doug LaFon

technology "campaigns" that address an expanse of issues: human sciences, information sciences, sciences for maneuver, sciences for lethality and protection, materials research, computational sciences, assessment and analysis, and extramural basic research.

ARL's diverse assortment of facilities and its workforce of government engineers and scientists comprise the largest source of world-class integrated research and analysis in the Army.

In addition, through programs like ARL's Open Campus program—cited in January by the Defense Science Board as "innovation that can serve as a role model to the broader defense research enterprise"—ARL engages in cooperative research and development agreements (CRADA). Currently at 60 private-sector companies and more than 40 universities

Focused on Future



Physicist Grace Metcalfe works in the U.S. Army Research Laboratory's Sensors and Electron Devices Directorate in Adelphi, Md.

and growing, ARL's CRADA partners and other collaborative outreach programs leverage the substantial intellectual resources of the global academic scientific research community. Such diverse subject-matter experts working together on Army-focused research raise the odds that a novel solution or invention will emerge to accelerate Army innovation.

But research is a slow, methodical process. And while the day-to-day movement in scientific research is painstaking, there are eureka moments that create seismic shifts in our understanding of the world and how science can protect the Army and the nation.

A short list of groundbreaking innovations by ARL scientists includes laser-induced breakdown spectroscopy (remote

active sensing to identify explosive and biological molecules), flexible armor, lithium-ion battery improvements using a salt combination, lithium sulfur batteries, tunable microwave devices, language translation technologies, and flight testing of 3-D printed unmanned aircraft systems created on-demand for specific missions.

Best-Kept Secret in DoD

Despite the size and scope of ARL's contribution, the lab is perhaps the best-kept secret in DoD because once scientists complete their research, they move to the next problem. Their focus is the underpinning research that is transitioned for use in the defense of the United States, not to increase the price of a particular stock or grow corporate profits.

To increase awareness and amplify ARL's ongoing commitment, the lab has launched a year-long initiative called ARL25. The initiative is designed to share the story of the lab's people and culture, raise awareness of the impacts of its world-changing scientific and technological achievements, and increase robust collaboration.

"ARL25 is our way of shedding light on the many impacts ARL has had and continues to contribute to the Army, United States citizens and the global community," Perconti said. "We invite partners across government, academia and the private sector to help us celebrate ARL's rich history and to participate in laying the groundwork for future invention to protect American soldiers."

World-changing contributions from ARL and the predecessor labs that merged into ARL in 1992 include the Facial Recognition Technology database; mobile ad hoc networks; the proximity fuze; ENIAC, the world's first digital computer (at a cost of less than \$500,000); growth of synthetic large quartz crystals and developing the titanium alloy T1-6A1-4V; and a longstanding history of excellence in robotics and optics.

Much of ARL's work is transitioned to others for application. For example, ARL-pioneered Face Gear technology is flying as flight-critical hardware, making a performance difference on board Army aviation systems today.

More broadly, ARL focuses on ongoing and extensive research into emerging fields that hold the promise of novel or vastly



The shell and propeller arms of this small unmanned aircraft system were created by 3-D printing.

improved capabilities on behalf of the Army. It also focuses on defense-related efforts for other government agencies including NASA and the Defense Advanced Research Projects Agency.

Open Campus Program

Direct and ongoing interaction with warfighters and researchers from academia and industry is critical to ARL's mission focus. Scientists from around the world participate in ARL's Open Campus program, which encourages fundamental research collaboration with ARL scientists and engineers.

Open Campus reflects the mindset referenced by ARL chief scientist Joseph Mait when he said, "An open, empowering, relevant and accountable environment enables fluid transfer of ideas and technology between ARL and its domestic and international technical partners in academia and industry, and between ARL and its Army compatriots."

Open Campus enables self-forming, expertise-driven teams well-positioned for competitive research; and exposes scientists, engineers, professors and students to realistic research applications and perspectives. This strengthens U.S. competitiveness in these critical fields.

After spending a day at Open Campus with ARL scientists and visiting researchers, Maj. Gen. Walter E. Piatt, director of operations and director of rapid equipment fielding in the Army Rapid Capabilities Office, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology, said, "It's easy to talk about innovation, but it's much harder to actually do it and make it relevant for soldiers. After meeting the brilliant people working in Army labs and seeing what they produce, I know that their work saves lives."

Here are some more examples of ARL facilities, programs, events and resources:

- **Network Science Research Laboratory:** This state-of-the-art facility at the Adelphi Laboratory Center is dedicated to exploring network science challenges with in-person research collaboration. Researchers from ARL's Network Science Collaborative Technology Alliance Experimentation Team re-

cently held the first Network Science Research Laboratory "Hackathon" there.

- **IP Store:** Available to the public, ARL's online intellectual property store enables visitors to browse, research and apply for a license to make, use and sell patented technology from ARL at favorable, pre-negotiated terms.

- **ARL centers:** ARL is reversing the 1990s consolidation trend and establishing new sites across the country where new technologies are being developed, attracting a local talent pool from major universities. ARL West was established in Los Angeles to tap into leading work on interaction between humans and information. ARL South, in Texas, opened in 2016, and additional centers are planned.

- **Sabbaticals:** To increase ARL's "surface area" with external partners, ARL encourages sabbaticals for staff members who are in close contact with academic researchers on the cutting edge of turning science into technology. Returning scientists bring new insights and perspectives into the lab.

- **Scientific Services Program:** An accelerated contract mechanism enables federal government organizations to obtain specialized scientific and technical services to accomplish organizational goals and mission objectives related to research and development.

ARL has consistently provided the enabling technologies for many of the Army's most important weapons systems. Technology and analysis products are moved into the Army's research, development and engineering centers and to other Army, DoD, government and industry customers. ARL's programs enable the transformation of the Army into a more versatile, agile, survivable, lethal, deployable and sustainable force.

To equip the force of the future, the Army need look no further than within its own ranks, to the able men and women at ARL. ★

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