Accelerating Innovation and Discovery at ARL and Beyond

Dr. Joseph Mait
Chief Scientist
U.S. Army Research Laboratory

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U.S. Army Research Laboratory

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Vision

The Nation's Premier Laboratory for Land Forces.

Mission

DISCOVER, INNOVATE, and TRANSITION Science and Technology to ensure dominant strategic land power

Making today's Army and the next Army obsolete

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Open Campus

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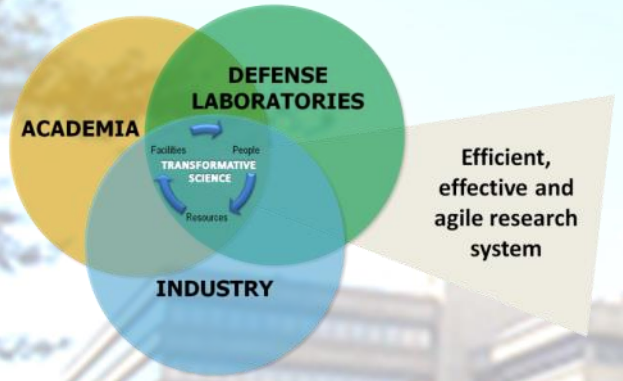

Efficient, effective and agile research system

ARL Transformation Principles

Flow, Agility, Quality, Efficiency & Effectiveness

ATTRACT AND RETAIN BEST & BRIGHTEST	OPEN CAMPUSES	SHARED MODERN FACILITIES	INNOVATION PRACTICES
Create flexibility and agility to make workforce changes to keep pace with rapidly evolving technologies and national security requirements	Onsite collaboration with academia and industry through layered security process; ARL as anchor within community	Enable greater sharing of specialized facilities between agencies, private sector partners, and experiment with new models for modernizing labs	Implement strategies and policies that support exploitation of science and transition to small business and entrepreneurs

Piloting a New Laboratory Business Model
Responding to the National Security Challenges of the 21st Century

Open Campus

Enabling a Strong Collaboration Ecosystem

- Partners include international and domestic:
  - Academia
  - Industry, Small Business
  - Government, Military
- Research efforts align with partner research interests and ARL S&T Campaigns
- International collaborations enabled by updated policies, layered security, dedicated facilities & network access
- Entrepreneurial activities enabled
- Efficient, effective, and agile research system created through collaboration
- Responds to national security challenges of the 21st Century

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Collaborative Academic Research

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Research Exchanges:

Prof. Patrick Mather, Syracuse University

- One year sabbatical at ARL to investigate the rate dependent mechanics of polymer blends
- Exploring the processing-structure-mechanics relationships in novel phase separating polymer blends
- Modeling the polymer blends with well controlled chemistry, composition, and morphology.

Dr. Steven Keller, ARL

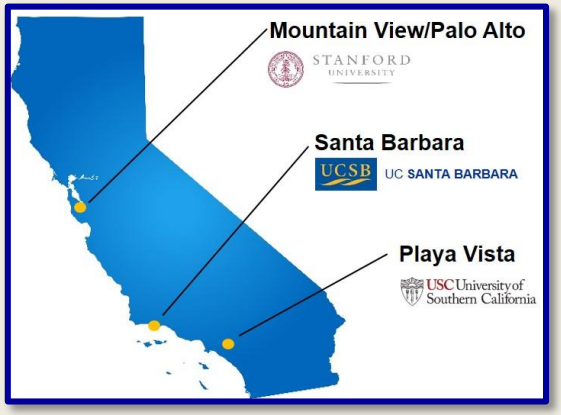
- Three year detail at UMass Amherst
- Investigating feasibility of textile-integrated carbon nanotube antenna fabrication with U. Cincinnati
- Collaboration with NSRDEC and UMass (Amherst and Lowell) on conductive textile and flexible antenna research and fabrication

Cyber Collaborative Research Alliance with Penn State

- 20 graduate and undergraduate researchers have completed a research experience at ARL
- 5 undergraduate students hired through pathways program

ARL West

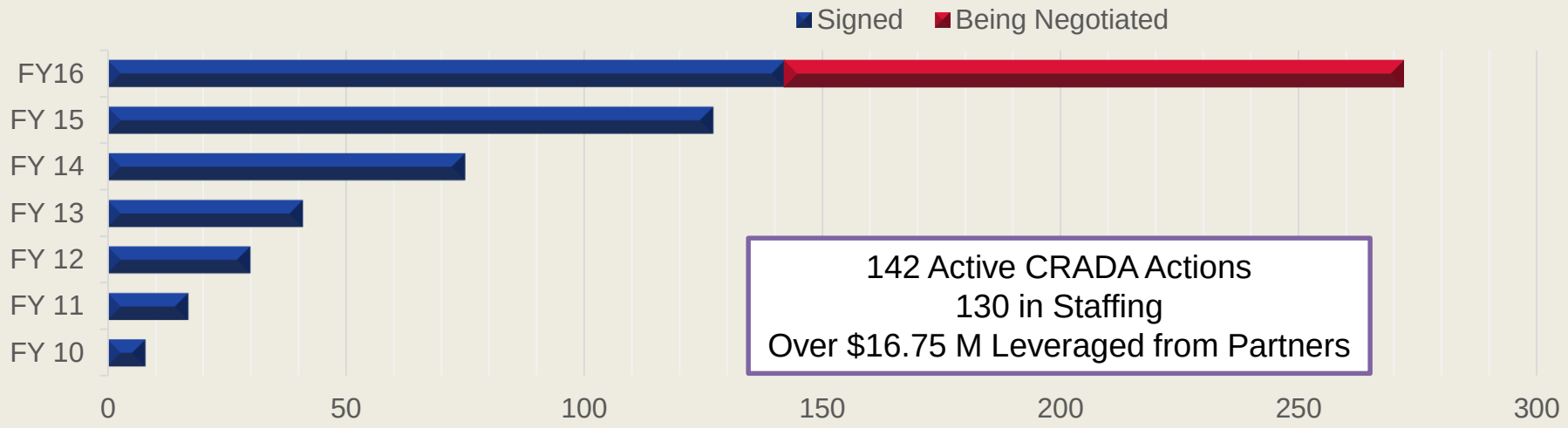
- Local hub for west coast university interactions & recruitment
- Leverage ongoing research at ICT & USC Information Sciences Institute
- ARL-distinct facilities are available at the USC Institute for Collaborative Technology (ICT) UARC
- Excellent potential for increased innovation through closer collaboration with USC & ICT research staff



Partnering with ARL

- Almost 520 participants established collaborative partnerships on-site in ARL laboratories.
  - 190 undergraduate students, 86 graduate students, 30 post docs, and 20 faculty
  - 54 international collaborators from 19 countries, including China, India, Germany, South Korea, Iran, and Turkey, with balance from 4 continents.

CRADA Actions (Cumulative)



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Expanding the Network Internationally

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SIGNED

Chernihiv National University of Technology – Ukraine
POC: Dr. Alexander Kott
CRADA in Information Sciences

National Technical University of Ukraine - "Kyiv Polytechnic Institute"
POC: Dr. Alexander Kott
CRADA in Information Sciences

IN PROCESS

Australian National University
Australia
POC: Dr. James Carroll
CRADA in Materials Research

Nanyang Technical University
Singapore
POC: Dr. Govind Mallick
CRADA in Materials Research

University of Sydney
Australia
POC: Dr. Weimin Zhou
CRADA in Materials Research

University of Olso
Norway
POC: Dr. Lance Kaplan
CRADA in Information Sciences

University of Alberta
Canada
POC: Tomoko Sano
CRADA in Material Sciences

Warsaw University of Technology
Poland
POC: Dr. Angelique Scharine
CRADA in Human Sciences

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ARL S&T Campaigns

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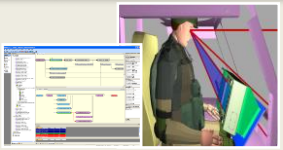
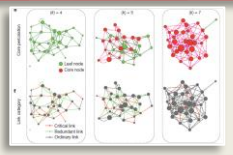
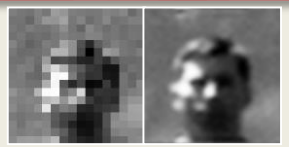
Extramural Basic Research

Human Sciences

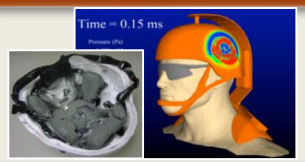


Information Sciences

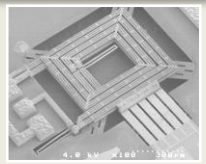


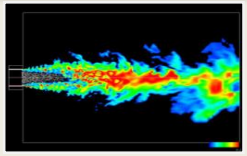


Sciences for Lethality & Protection



Sciences for Maneuver





Computational Sciences

Materials Research

Assessment and Analysis

ARL Campaign Publications: http://www.arl.army.mil/publications

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ARL's New Research Centers

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Aberdeen Proving Ground, MD

Adelphi, MD

Army Cyber Research Center
Intelligent Systems Research Center (APG/ALC)
Center for Research in Extreme Batteries
Network Science Research Center
Specialty Electronics Center

White Sands Missile Range, NM

Atmospheric Sciences Center

Orlando, FL

Simulation and Training Technology Center

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Talented Workforce

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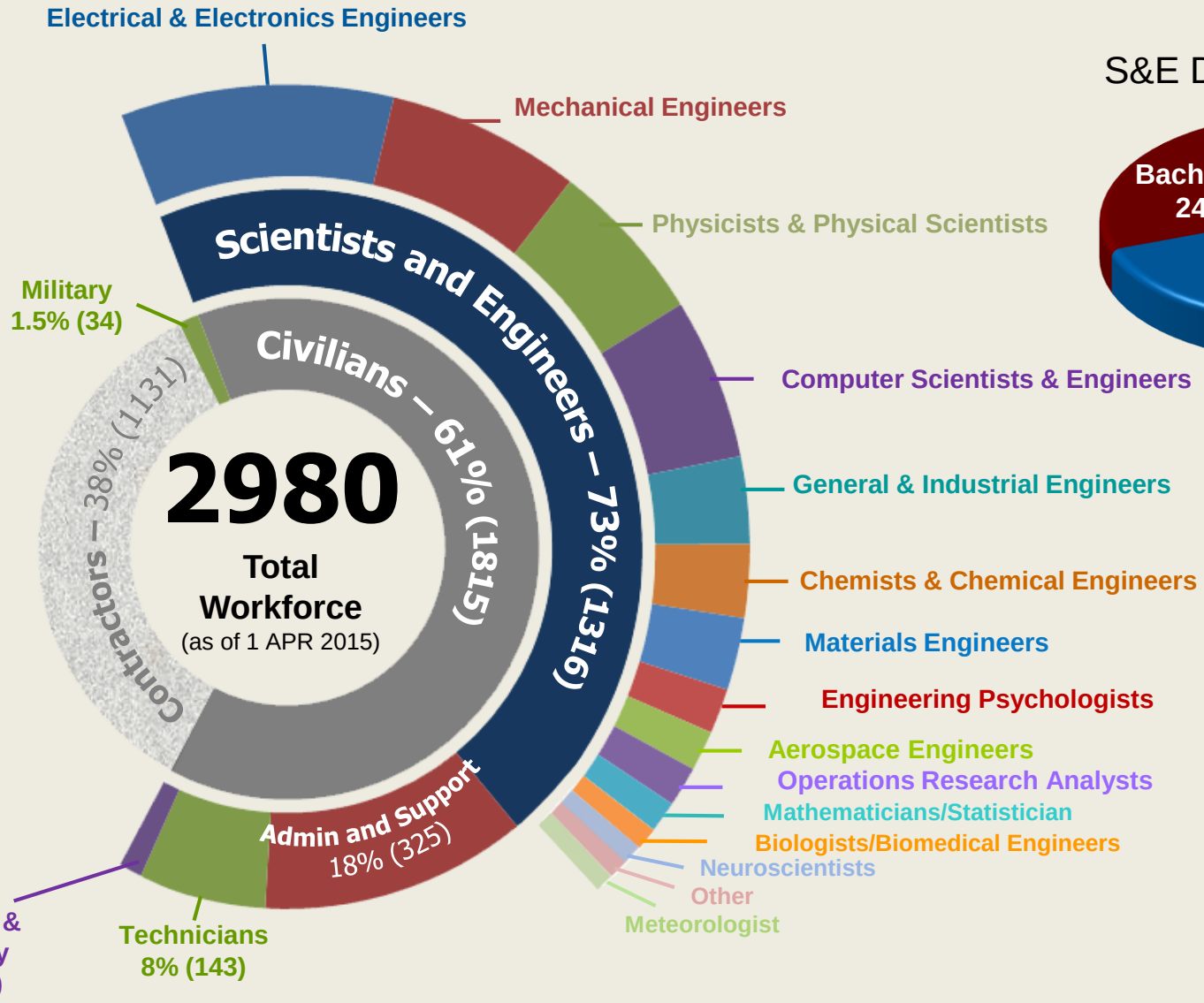
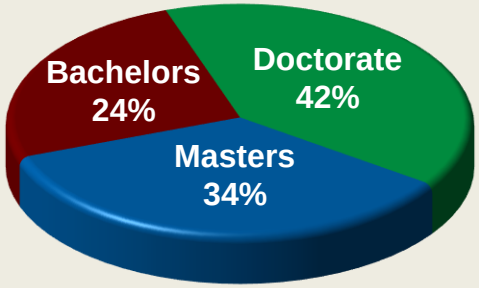


S&E Degree Distribution



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How can you engage in ARL's Open Campus?

- **Explore** www.arl.army.mil/opencampus
  - Review collaboration opportunities and ARL Facilities
  - Start a dialog with ARL researcher
  - If appropriate, develop joint statement of work within CRADA
- **More Information at** www.arl.army.mil
  - Army Science Planning & Strategy
  - ARL Technical Strategy 2015-2035
  - Research@ARL
- **Open Campus Open House**

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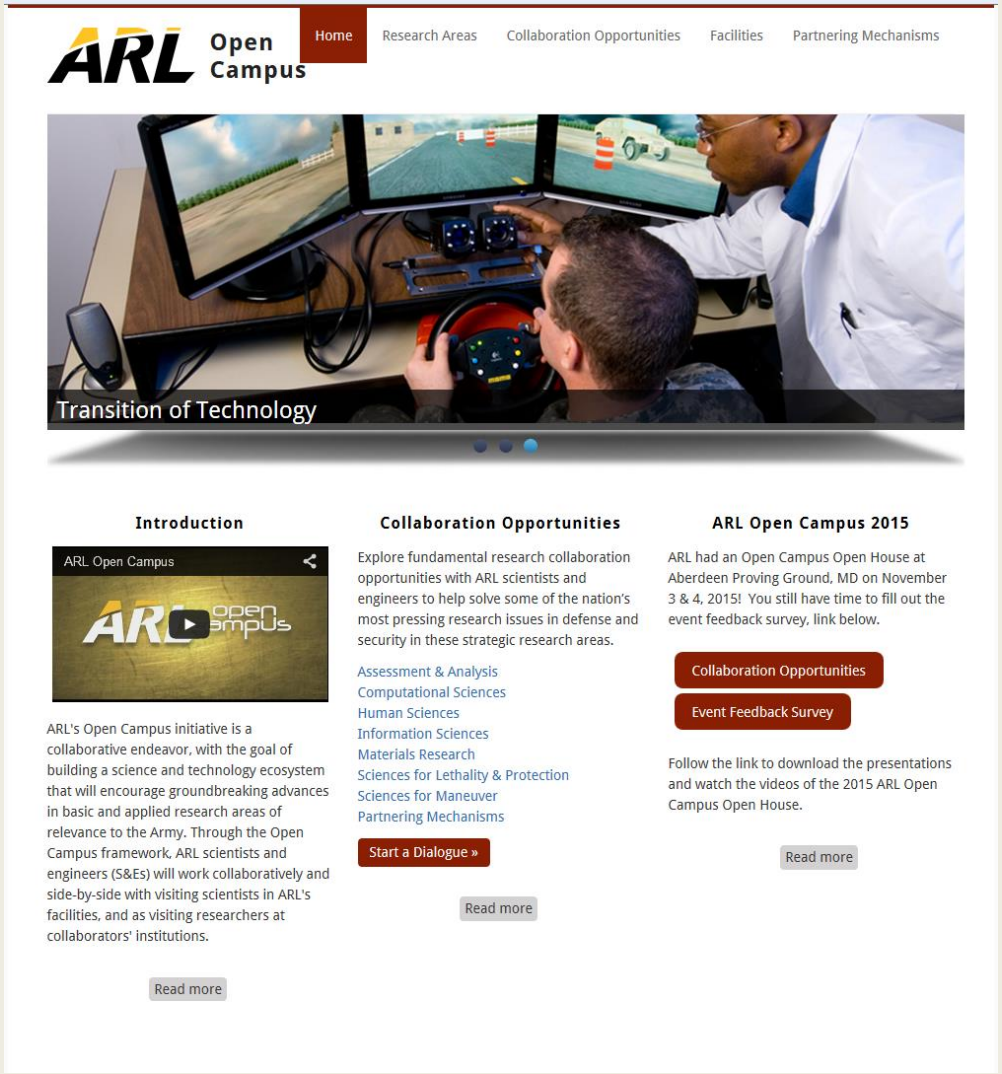

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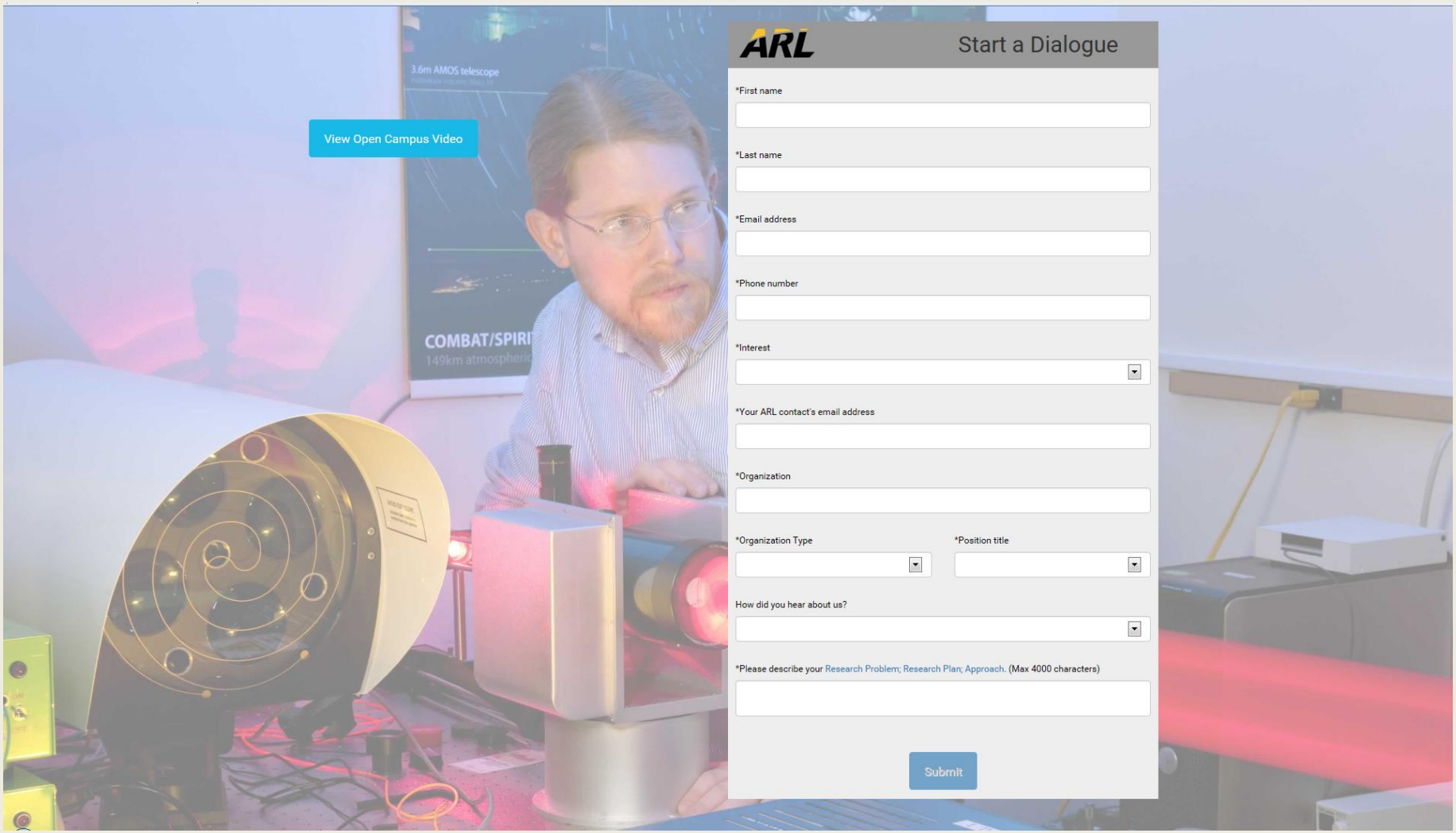

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ARL Open Campus Open House *2015*

Collaboration Opportunities | My Selections 0

Collaboration Opportunities

ARL's Open Campus business model fosters entrepreneurial engagement and supports collaboration between ARL, academia, government, industry, and small business, both nationally and globally, to help find solutions to some of the nation's most pressing defense and security issues.

Browse our collaboration opportunities below and select one or more areas of interest.

Then tell us about yourself and your own ideas on the My Selections page.

Browse by campaign area: Sciences for Maneuver

Search:

Sciences for Maneuver

Sciences for Maneuver - Overview and Facilities

Principal Investigator
Ms. Wendy Winner

Power Electronics for Tactical Energy Networks and Mobile Platforms

Principal Investigator
Mr. Morris Berman

Soldier and Small System Energy

Principal Investigator
Dr. Christopher Waits

Fuel Processing Power Sources

Principal Investigator
Dr. Ivan Lee

High-Efficiency Gas Turbine Engine Components

Principal Investigator
Mr. Waldo Acosta

High Temperature Propulsion Components Laboratory

Principal Investigator
Dr. Anindya Ghoshal

Soldier and Small System Energy

S&T Campaign: Sciences for Maneuver
Energy and Propulsion

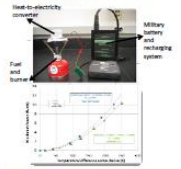
C. Mike Waits, Ph.D., (301) 394-0057, christopher.m.waits.civ@mail.mil
Patrick Taylor, Ph.D., (301) 394-1475, patrick.j.taylor36.civ@mail.mil
Ivan Lee, Ph.D., (301) 394-0292, ivan.c.lee2.civ@mail.mil

Research Objective

Investigate energy harvesting and conversion to enable extended duration, expeditionary-type missions with minimal physical burden and without the need for resupply

Wearable Energy Harvesters

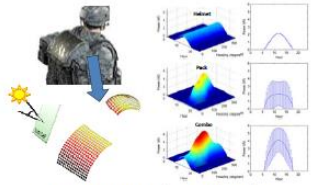
Man-portable Battery Recharging From Scavenged Waste Heat



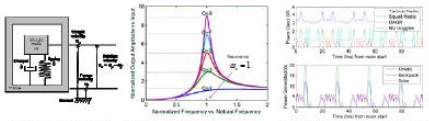
- Very High Power Density Values:
  = 10 Watts/0.0016m² ~ >5000 Watts/m²

Challenges

- Energy harvester models must account for realistic usage profiles and cover multiple scales from system level to device physics level for adaptability
- Materials with high transduction efficiency for thermal to electrical energy conversion
- Component- and system-level models capable of informing materials development for optimization of specific energy, power density, and/or thermal performance



Conformal photovoltaic panels in motion



Electromechanical energy harvesting | Quality factor: Frequency selectivity vs. power output | Predicted energy usage and generation for mock scenario

ARL Facilities and Capabilities Available to Support Collaborative Research

- State-of-the-art III-V MBE system for PV, PEC materials and IV-VI MBE system for TE materials
- Ultrahigh vacuum variable temperature STM for tunneling spectroscopy and atomic imaging
- Device processing and characterization
- Unique thermoelectric materials zT characterization and device efficiency/power-density evaluation
- Time domain thermoreflectance pump-probe thermal characterization system
- LabVIEW controlled catalytic reactors, micro-GC and mass spectrometer, FTIR spectrometer with in-situ time-resolved capability, physisorption-chemisorption analyzer

Complementary Expertise/Facilities/ Capabilities Sought in Collaboration

- Energy-harvesting devices for characterization and modeling in Army-relevant scenarios
- Devices and topologies that exploit multimodal energy transduction for more power dense and predictable generation
- Thermal-to-electric materials and devices development partners
- Fuel combustion catalysts development
- Multifuel or JP-8 fueled mesoscale and micro-combustion modeling and device development
- Energy conversion and harvesting component integration and systems modeling

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ARL Open Campus Open House *2015*

Collaboration Opportunities | My Selections 1

Collaboration Opportunities

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ARL Open Campus Open House *2015* | Collaboration Opportunities | My Selections 1

My selections

Please provide a detailed description of your fresh ideas or new concept within your research area. Your explanation will allow the ARL researcher to gain a key insight into how a future collaboration could mature.

Soldier and Small System Energy

Campaign Area
Sciences for Maneuver

Principal Investigator
Dr. Christopher Waits

* Please describe your research interest:

Remove from my selections

My information

* First Name:

* Last Name:

* Email:

* Phone:

* Organization:

* Organization Type:

* Position Title:

Address Line 1:

Address Line 2:

City:

State:

Zip Code:

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2016 Open Campus Open House
November 2016 at Adelphi, MD

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Be Part of our Vision!

- Goal of the event is to introduce the S&T community to ARL's research scientists and engineers with whom you might collaborate and to ARL's specialized laboratory facilities that are available to support joint research.
- Two day event will feature a variety of scheduled presentations, tours, and opportunities to meet one-on-one with the Army's leading researchers.

Who Should Attend?

- Innovators of all types: Academic Vice-Provosts for Research, Deans, and Professors; Industry Technical Staff and Management; Small and Large Businesses; Business Developers; Government Research Laboratory Technical Staff and Management.

If Interested:

- Send contact information (name, title, organization, and email) to opencampus@arl.army.mil and we will provide notification as the event matures.

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Questions