



## VISION

The vision of ARL Central is to accelerate discovery, innovation, and transition of science & technology to the Army through forging strategic regional partnerships via the Army's Open Campus Business Model



Army Research Laboratory (ARL) Central  
1452 E 53rd Street, 2nd floor (Polsky, U Chicago)  
Chicago, IL 60615

## ARL-C RESEARCHERS

Government Civilians  
Joint Faculty Appointments  
Postdoctoral Researchers  
Graduate Student Researchers  
ARL Central Extended Researchers

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## GOALS

- Establish regional campuses to jointly solve Army technology needs
- Establish close ties with academia, laboratories, start-ups and established companies
- Access large pool of subject matter experts from academic and non-academic partners
- Capitalize on strong academic institutions and graduates within region

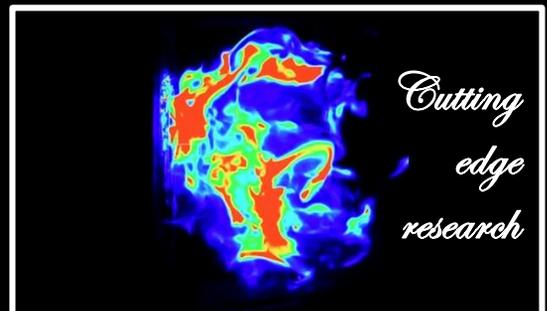
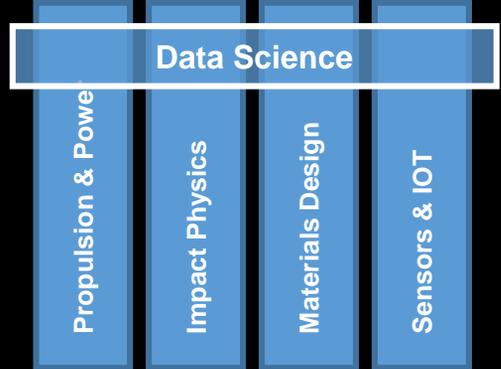
## RESEARCH THRUSTS

Propulsion and Power, Impact Physics & Energetic Materials, Materials Design, Sensors & IOT, Data Science

<https://www.arl.army.mil/opencampus/>



For further information, contact:  
**Mark Tschopp**  
Regional Lead, ARL Central  
US Army Research Laboratory  
[ARLCentral@arl.army.mil](mailto:ARLCentral@arl.army.mil)





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## Propulsion Science and Materials Roadshow

ARL established the Center for UAS Propulsion with four academic institutions: University of Illinois at Urbana—Champaign, University of Illinois at Chicago, Northwestern University, and University of Wisconsin--Madison. ARL is engaging with joint faculty appointments and senior leadership (Vice Chancellor of Research, Vice President of Research, Federal Liaisons) to communicate Army needs, how they can be addressed through this partnership, and the impact that these partnerships will have on local/state industry as well as on the education and training of students. This partnership will support the Center for UAS Propulsion, the Propulsion Science and Materials research thrust in ARL Central, and the Versatile TaCTical pOwer and pROpulsion (VICTOR) Essential Research Program (ERP).

POC: Mike Kweon, Tonghun Lee, Julie Foresta, Walter Roy, Mark Tschopp

## ARL Central: Energetic Materials to Smart Cities & IOBT

The center of gravity for the Internet of Battlefield things (IOBT) cooperative research agreement (CRA) will be located in ARL Central. This includes partners inside and external to the current IOBT CRA. External to the IOBT, ARL is working with the University of Chicago to focus on Data Science, a joint IOT laboratory, and technologies related to smart cities and installations. We are planning a workshop on smart cities and installations at ARL Central, to be held in late spring 2019, to formalize problems, form teams to tackle these problems, and formally kick off this effort with University of Chicago and other partners, including Argonne National Laboratory and University of Illinois at Urbana—Champaign.

ARL is also working with Purdue University to partner on a research thrust in energetics. The Purdue Energetics Research Center (PERC), Next Offset Solutions (a startup specializing in 3D printing of energetic materials), and Adranos (a finalist in xTechSearch 1.0) offer unique opportunities to engage academia and small business to address existing and emerging explosives-based threats to civilian and military infrastructure, commerce, and aviation. It also targets the U.S. military's need for more stable, more effective, less sensitive, and more easily processed energetic materials for use as propellants, pyrotechnics, and in ordinance.



POC: Jennifer Ciezak-Jenkins, Sarah Isert, Wayne Churaman, Jason Robinette, Elbert Caravaca (ARDEC), Mark Tschopp



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## ARL Visit to U Chicago for Future Data Science & IOBT Effort

ARL visited the University of Chicago to talk with faculty and administration in Computer Science department about Data Science and IOBT. The one-day visit started with briefings by Drs. Russell, Swami, and Raglin about IOBT, IOT and ARL thrusts in data science. Meetings included computer science department chair, Director of Office of Research, Polsky representatives, Director of Center for Data and Computing (CDAC), and Argonne scientists. A number of faculty presented their work, followed by a brief tour of the new Computer Science building at the University of Chicago. Discussions included reference to University of Chicago's new Center for Data and Computing and work on 'Array of Things,' an effort that puts sensors on street corners throughout Chicago. Future IOT/Data Science workshop, joint IOT laboratory, and cooperative agreement are in process.

POC: Stephen Russell, Ananthram Swami, Adrienne Raglin, Mark Tschopp

## ARL Central Roadshow: Past, Present, and Future

ARL Central held multiple seminars at ALC and APG to share information, progress, and ideas about the vision of ARL Central, the timeline, the people, the facilities, the opportunities, the focus areas, and overall how the ARL Central enterprise operates. The surveys collected afterwards solicited feedback about how ARL's regional sites can be improved, what questions people still have, what things should be on our radar within ARL Central, and what interested attendees about ARL Central and its operating model. Follow-up efforts include summarizing feedback along with frequently asked questions and answers. Initial feedback indicated that the content was helpful for understanding how these operations run and fit in with the broader ARL context. The material will be extended to ARL Central partners in the future.

POC: Mark Tschopp

## "Isomer Power Source" ASPSM at U Chicago's Polsky Center

This Army Science Planning and Strategy Meeting (ASPSM) on "Isomer Power Source" held at ARL Central, brought together communities of subject matter experts (about 25–30) in nuclear physics, energy conversion, and energy technologies to better understand the implications of this study on future technologies for the soldier. The ASPSM participants outlined scientific challenges and pathways for basic research to better understand the NEEC process and to understand energy technologies required from a novel, long-duration, isomer heat source. This discovery was highlighted as #1 discovery for ARL in 2018, and was highlighted as one of Argonne National Laboratory's top 10 discoveries in 2018 as well.



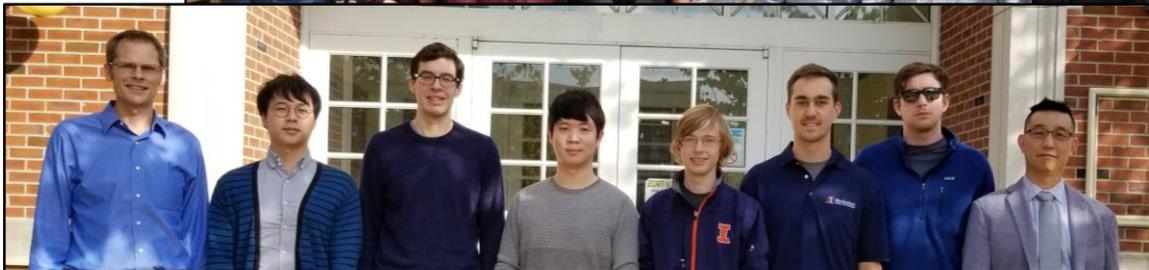
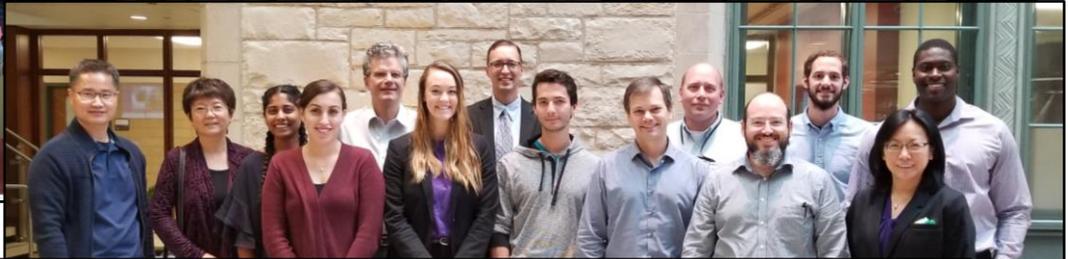
POC: Jeff Carroll, Justin Shumaker, Mark Tschopp



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## Propulsion Science and Materials

The Propulsion Science and Materials research area involves multiple academic institutions (University of Illinois at Chicago, Northwestern University, University of Illinois at Urbana—Champaign, and University of Wisconsin--Madison) and Argonne National Laboratory in a collaborative partnership with ARL's Vehicle Technology Directorate (VTD). The collaborative relationship involves ARL researchers at ARL Central through joint faculty appointments, postdoctoral research associates, and graduate students. Each ARL researcher in ARL Central is supporting mission programs aimed at Multi Fuel Capable Hybrid Electric Propulsion in association with the ARL Center for UAS Propulsion within ARL Central. The research in this large program supports capability for Future Vertical Lift.



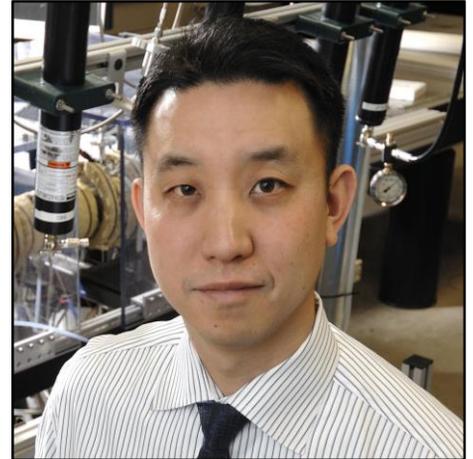
ARL POC: Mike Kweon, ARL-VTD; Tonghun Lee, ARL-VTD and UIUC



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## Dr. Tonghun Lee

Dr. Tonghun Lee is an ARL joint faculty appointment, in the Propulsion Science and Materials thrust. Dr. Lee is a Professor in the Department of Mechanical Science & Engineering at the University of Illinois at Urbana—Champaign. Dr. Lee is the cofounder of the ARL Center for UAS Propulsion (CUP), which was formally kicked off in May 2018 and will act as the academic lead. As part of this effort, Dr. Lee, his students, and ARL collaborators have conducted the first combustion science experiment at Argonne National Laboratory's Advanced Photon Source early in 2018. His research interests are in propulsion, combustion science, fuels, as well as laser and optical diagnostics. Through CUP and other collaborations, he is supporting the ARL mission program in developing the next generation multi-fuel capable hybrid electric propulsion systems for Future Vertical Lift.



## Dr. Blake Johnson

Dr. Blake Johnson is a tribological researcher and mechanical engineer working as an ARL postdoctoral research associate. His work at ARL involves the development of engine systems capable of running low-viscosity fuels that have a range of chemical properties. Dr. Johnson earned a BS degree in Mechanical Engineering from The University of Texas at Austin, where he participated in research on nanocomposites and 3D Printing. He then earned a Masters and PhD at Northwestern University, studying lubricant additives and Tribology. His graduate research involved specialized lubricant additives that reduce lubricant contamination, friction, and wear. He has extensive experience in tribological testing, contact modeling, statistical surface analysis, and spectroscopy.



## Dr. Daniel Bodony

Dr. Daniel Bodony is an ARL joint faculty appointment, in the Propulsion Science and Materials thrust and the Blue Waters Associate Professor in Aerospace Engineering at the University of Illinois at Urbana—Champaign. Dr. Bodony and his students use high-fidelity computational simulation tools to improve the performance, reliability, and safety of key propulsion systems and subsystems. His simulation data are combined with experimental measurements taken by his ARL collaborators to determine causes of component failure and support component redesigns, as well as to develop reduced-order models suitable for design. Dr. Bodony is a charter member of the ARL Center for UAS Propulsion (CUP) and an expert in acoustics, fluid-structure interaction, adjoint-based design optimization and flow control.





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## Mr. Mohammed Abdulrahman



Mr. Mohammed Abdulrahman is a PhD student in Mechanical Engineering at the University of Illinois at Chicago conducting research at the High Pressure Shock Tube Laboratory. His experimental research models the kinetics of combustion chemistry during pyrolysis and oxidation of hydrocarbon fuels. He works with Prof. Ken Brezinsky and Dr. Jacob Temme (ARL). He graduated from UIC with a MS degree in Mechanical Engineering in 2018 and BE in Mechanical Engineering from Osmania University, India in 2016. In his free time, he loves playing soccer.

## Ms. Marisa Bisram



Ms. Marisa Bisram is a PhD student in Mechanical Engineering at Northwestern University studying lightweight composite materials for power transfer with Professor Jian Cao and Dr. Stephen Berkebile (ARL). Marisa received her BS in Mechanical Engineering at the University of Delaware, where she participated in research on RTM and VARTM processing. In her free time, Marisa enjoys beekeeping and fiber arts such as weaving and crochet.

## Mr. Austen Motily



Mr. Austen Motily is a PhD student at the University of Illinois at Urbana—Champaign studying combustion and optical diagnostics with Prof. Tonghun Lee and Dr. Kenneth Kim (ARL).

Mr. Austen Motily is investigating energy assistance methods for compression ignition of low cetane number fuels, which can be applied for both land and avionic vehicle propulsion. He received a BS degree in mechanical engineering with an international engineering option from the University of Wyoming. Austen studied engineering during semesters abroad in both France and Germany at the Université Blaise Pascal and the Hochschule Mannheim.

## Ms. Jennifer Bennett



Ms. Jennifer Bennett is a PhD student in Mechanical Engineering at Northwestern University, studying under Professors Jian Cao and Kornel Ehmann and collaborating with Dr. Michael Walock (ARL).

Ms. Bennett's research focuses on controlling the thermal history throughout the build for the metal additive manufacturing process, thereby tailoring the microstructure and mechanical properties for the final part. She graduated in 2014 with a BS in Mechanical Engineering and an MS in Mechanical and Aerospace Engineering from the Illinois Institute of Technology (IIT).



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## Mr. John Klein



Mr. John Klein is a PhD student in Civil and Materials Engineering at the University of Illinois at Chicago studying mechanical metamaterials with Prof. Eduard Karpov and Dr. Thomas Plaisted (ARL). His work focuses on a new class of structural composites able to control how surface forces propagate inside the material. John is proud to be on board the ARL team and will be making the most of the next 2 years until completion of his dissertation.

## Ms. Jennie Glerum



Ms. Jennie Glerum is a PhD student at Northwestern University studying the microstructure and mechanical properties of additively manufactured aluminum alloys with Prof. David Dunand and Dr. Michael Walock (ARL).

Ms. Glerum is also collaborating with Jennifer Bennett and Prof. Jian Cao in NU Mechanical Engineering to characterize the effects of processing parameters and thermal cycles on additively manufactured Inconel alloys. She graduated in 2017 from MIT with a B.S. in Materials Science and Engineering and a minor in Nuclear Science and Engineering. In her free time she enjoys playing volleyball and baking.

## Mr. Michael Groendyk



Mr. Michael Groendyk is a PhD student at the University of Wisconsin—Madison studying ignition processes in fuels with extreme physical properties with Prof. Dave Rothamer and Dr. Jacob Temme (ARL). His work is focused on studying the fundamental challenges of burning alternative fuels in existing engines. This will improve the flexibility of fielded hardware by making it potentially fuel agnostic.

## Mr. Alan Goertz



Mr. Alan Goertz is a PhD student at Wayne State University studying impact biomechanics with Prof. King Yang & Dr. David Viano and Mr. Neil Gniazdowski & Dr. Christopher Hoppel (ARL). He supports the Blast Protection and Soldier Protection Sciences Branches, providing injury assessment for under-body blast and behind armor blunt impacts using FE human modeling.



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## Dr. David Rothamer

Dr. David Rothamer is an ARL joint faculty appointment, in the Propulsion Science and Materials thrust. Dr. Rothamer is an Associate Professor in Mechanical Engineering at the University of Wisconsin—Madison (UW-Madison). Dr. Rothamer is the Director of the UW-Madison Engine Research Center, a world-renowned center focused on engine combustion. He is also a Harvey D. Spangler Faculty Scholar in the College of Engineering at UW-Madison and a principal investigator in the Great Lakes Bioenergy Research Center. His research interests are in engine combustion science, laser diagnostic development and application to practical combustion problems, fuel impacts on combustion, and particulate matter formation and filtration. Through CUP and other research, he is supporting the ARL mission program in developing the next generation multi-fuel capable hybrid electric propulsion systems for Future Vertical Lift.



## Dr. Carolyn Hampton

Dr. Carolyn Hampton is an ARL biomedical engineer, stationed with the Neuroscience Research Laboratory at the Medical College of Wisconsin in Milwaukee, WI. She is a graduate of the Virginia Tech biomechanics program and uses computational tools including finite element analysis to study blunt and ballistic injury biomechanics. Dr. Hampton supports efforts to protect soldiers by simulating potentially injurious scenarios and validating the results with experimental data from collaborators at the Medical College of Wisconsin. This data supports work on protective equipment to avoid and minimize future injuries. Her background includes automotive and roadside crashworthiness, human body modeling, and chest and lower extremity protection.

## Dr. Je Ir Ryu

Dr. Je Ir Ryu is an ARL postdoctoral fellow, in the Propulsion Science and Materials research thrust. Dr. Ryu is stationed at the Argonne National Laboratory, working with Dr. Sibendu Som and Dr. Riccardo Scarcelli on computational modeling of ignition and combustion. He received his Ph.D. in Mechanical Engineering at the University of California, Berkeley in 2018. He supports ARL's Multi-fuel-Capable Hybrid Electric Propulsion Program with numerical simulations and analysis. His research interests include ignition and combustion modeling, computational fluid dynamics of reacting flows, and simulations of propulsion systems with high performance computing. He is currently working on ignition assistant systems with the Dr. Chol-Bum "Mike" Kweon (ARL).





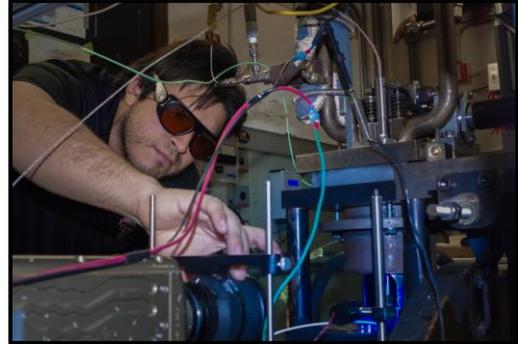
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## Mr. David Pickens III



Mr. David Pickens is a PhD student in Mechanical Engineering (ME) at Northwestern University in the tribology research area (BS/MS ME, Ohio State University). His current work with ARL involves failure analysis of fuel pumps for multi-fuel operation, including modeling and simulation of interfacial phenomena of the fuel pump during operation. In his free time, he enjoys playing chess and spending time with his family. He works under the guidance of Prof. Q. Wang and Dr. Stephen Berkebile (ARL).

## Mr. Eri R. Amezcua



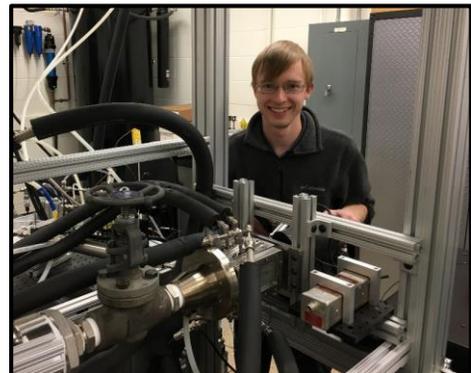
Mr. Eri R. Amezcua is a PhD student at the University of Wisconsin-Madison studying the characteristics of variable energy assisted compression ignition strategies with Prof. Dave Rothamer and Dr. Kenneth Kim (ARL). His work is focused on understanding the current state-of-art strategies for compression ignition to develop and tailor a new strategy to enable the less reactive fuels to be used over a wider range of conditions, in support of multi-fuel capability.

## Mr. Brendan McGann



Mr. Brendan McGann is a PhD student in Mechanical Engineering at the University of Illinois at Urbana-Champaign studying combustion and laser diagnostics with Prof. Tonghun Lee, Dr. Jacob Temme (ARL) and Dr. Kenneth Kim (ARL). His work focuses on the ignition and combustion of alternative fuels, and energy deposition assisted ignition. He received his BS degree in ME from Lehigh and his MS in aerospace engineering from Notre Dame.

## Mr. Eric Wood



Mr. Eric Wood is a PhD student in Mechanical Engineering at the University of Illinois at Urbana-Champaign studying combustion of alternative jet fuels with Prof. Tonghun Lee and Dr. Jacob Temme (ARL). Mr. Wood is employing the capabilities of Argonne National Laboratory's Advanced Photon Source to image fuel droplet breakup in a realistic gas turbine combustor.



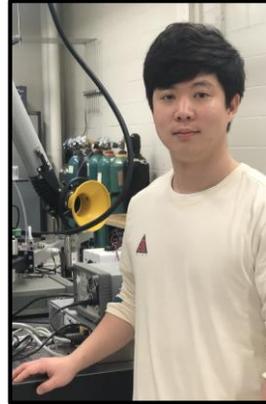
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## Mr. David Fellows



Mr. David Fellows is a PhD student in Aerospace Engineering at the University of Illinois at Urbana-Champaign studying fluid-structure interactions in turbochargers using CFD techniques with Prof. Daniel Bodony and Dr. Jacob Temme (ARL). His work aims to identify the mechanisms behind blade deformation and failure to inform improved turbocharger design. He graduated in 2017 from MIT with a BS in Aeronautics and Astronautics.

## Mr. Kyungwook Min



Mr. Kyungwook Min is a PhD student at the University of Illinois at Urbana—Champaign, MechSE with Prof. Tonghun Lee. He also received his MS degree at UIUC. He received his BS degree at Seoul National Republic of Korea, in Mechanical and Aerospace Engineering, and Technology Management.

His research is focused on investigating characteristic combustion behavior of advanced alternative aviation fuels for multi-fuel engine capability. To do this, rapid compression machines and shock tubes are used to evaluate chemical reactivity of the fuels and relevant hydrocarbon species at autoignition conditions.

## Mr. Keunsoo Kim



Mr. Keunsoo Kim is a PhD student at the University of Illinois at Urbana-Champaign in MechSE studying ignition of alternative & renewable fuels with Prof. Tonghun Lee and Dr. Jacob Temme (ARL). His work focuses on studying the auto-ignition characteristics, reactivity, and ignition-enhancement methods of extreme fuels to extend limits of ignitability. This produces both auto-ignition properties and induced ignition properties for fuels—fueling our understanding of multi-fuel capability for various combustion modes.

## Mr. Dmitriy Kats

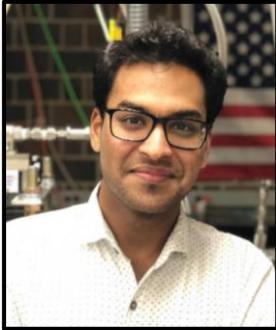


Mr. Dmitriy Kats is a PhD student in Mechanical Engineering at Northwestern University researching the additive manufacturing process with Prof. Wing Kam Liu, Prof. Greg Wagner, and Dr. Mike Walock (ARL). His research focuses on numerical modeling of the evolution of microstructure during the additive manufacturing process to better design materials with tailored structure and properties. In his free time, he likes to compete in triathlons and rock climb.



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## Mr. Anandvinod Dalmiya



Mr. Anandvinod Dalmiya is a PhD student at the University of Illinois at Chicago (UIC) in Mechanical and Industrial Engineering Department. He is working with Prof. Patrick Lynch and Prof. Kenneth Brezinsky from UIC and Dr. Jacob Temme (ARL).

He is working on “Time-resolved Formaldehyde measurements during Ignition and Combustion of Army relevant fuels” using High Repetition Rate Shock Tube (UIC) and Low Pressure Shock Tube (UIC). He pursued his undergraduate from School of Engineering and Technology—Jain University, Bangalore India.

## Mr. Bryan Maldonado



Mr. Bryan Maldonado is a PhD student in Mechanical Engineering at the University of Michigan-Ann Arbor studying feedback combustion control strategies for variable energy assisted compression ignition with Prof. Anna Stefanopoulou and Dr. Kenneth Kim (ARL).

His work aims to develop optimal combustion control strategies to minimize energy consumption while avoiding undesired combustion behavior, such as partial burns and misfires, in support of multi-fuel capability. He received his BS degrees in Mechanical Engineering and Mathematics from Universidad San Francisco de Quito, Ecuador.

## Mr. Nicholas Tee



Mr. Nicholas Tee is pursuing his Bachelor’s degree in Mechanical Engineering at the University of Cincinnati. He is a recipient of the DOD SMART Scholarship, and is a co-op student working with Mr. John Runyeon in the Weapons and Materials Research Directorate at the US Army Research Laboratory.

## SMART Scholarship



The Science, Mathematics And Research for Transformation (SMART) Scholarship for Service Program has been established by the Department of Defense (DoD) to support undergraduate and graduate students pursuing technical degrees in Science, Technology, Engineering and Mathematics (STEM) disciplines. The program aims to increase the number of civilian scientists and engineers working at DoD facilities.



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## Dr. Patrick Lynch

Dr. Patrick Lynch is an ARL joint faculty appointment, in the Propulsion Science and Materials thrust. Dr. Lynch is an Assistant Professor of Mechanical Engineering at the University of Illinois at Chicago. Dr. Lynch and his students use a combination of laser and other diagnostics, primarily in novel reactors like a miniature shock tube, in order to elucidate details on reaction rates, mechanisms, and ignition behavior in new fuels and blends. His research interests are in combustion science, chemical kinetics, ignition, and diagnostics. Dr. Lynch and other collaborators, including Dr. Ken Brezinsky at UIC are supporting an ARL mission program to characterize indigenous fuels and chemical markers as part of developing multi-fuel capable hybrid electric propulsion systems for the Army Modernization Future Vertical Lift priority area.



## ARL Central Researchers

The ARL researchers for ARL Central include government civilians, joint faculty appointments, postdoctoral researchers, graduate students, and researchers just outside the ARL Central region (extended researchers). For graduate students, only those that have been hired through an ARL Fellowship program are counted (excluding all Cooperative Agreements, CRADAs, and ARO-funded programs). The researchers outside of the ARL Central (defined as within a few hundred miles from Chicago, IL) are currently located at NASA Glenn, University of Cincinnati, and Wayne State University. Initially, no ARL researchers lived within the ARL Central region. The first ARL person stationed in ARL Central was the Regional Lead in December 2017.

Includes: 2 ARL government civilians, 4 joint faculty appointments, 2 ARL postdoctoral researchers, 17 graduate student researchers (on ARL Fellowship), and 7 extended researchers (4 government civilians, 2 graduate student researchers, 1 senior fellow).



## Dr. Mark Tschopp

Dr. Mark Tschopp is the Regional Lead for ARL Central, having previously served as a materials engineer, team leader, and branch chief in the Weapons and Materials Research Directorate. His prior research has been accelerated design of materials using a combination of modeling and simulation, data science, machine learning, and design optimization. In his current role, his mission is to accelerate discovery, innovation, and transition of science & technology to the Army through forging strategic regional partnerships via the Army's Open Campus Initiative, and to capitalize on strong academic institutions by leveraging the talent ecosystem for ARL within the Midwest.

For further information, contact:  
Mark Tschopp, US Army Research Laboratory  
[ARLCentral@arl.army.mil](mailto:ARLCentral@arl.army.mil)



# ARL CENTRAL

# ARL Central Timeline



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## Brief Snapshot of ARL Central

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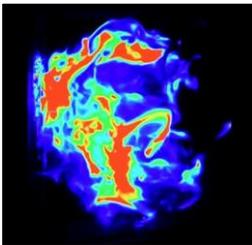


U.S. Army Research Laboratory announces new partnership

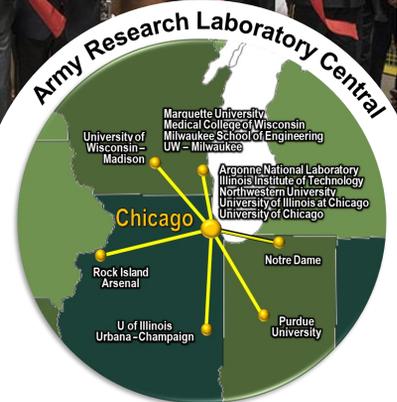
ARL, UChicago forge new partnerships in the Greater Chicago Area



Army Research Laboratory selects lead for ARL Central



Army researchers conduct first-ever combustion experiment with X-rays



Army lab, partners kick-off new effort to improve unmanned aviation



Ribbon Cutting

Regional Lead Video

X-Rays and CUP

ARL Central Video

YOUTUBE





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## Calendar (upcoming visits, events)

**February 27.** Site Visit and Seminar at Notre Dame about Army, ARL, the Army Open Campus Initiative, and ARL Central.

**February 28.** xTechSearch—Chicago.

**March 5.** IOBT CRA Boot Camp. Georgetown University.

**March 6–7.** Notre Dame—ARL Workshop. Day 1 features electronic/quantum materials, polymer materials, energetic materials, student poster session, and visits to bio center, nanofabrication, and energy efficient electronics facilities. Day 2 features visits to Wireless Institute (EW ERP), Turbomachinery (Power and Propulsion ERP), Autonomy & Drones, and HPC. Agenda features speakers from WMRD, SEDD, VTD, and ARO.

**April 2.** ARL Director to Visit Purdue Energetics Research Center.

**April 8–9.** Center for Distributed Quantum Information (CDQI) Workshop is being hosted at University of Chicago.

**April 18.** Chicago State University—Intelligence and Security Symposium. ARL keynote slot to talk about AI, ML, and Data Challenges.

**April 30–May 2.** ARL Center for UAS Propulsion (CUP) Kickoff Workshop 2019. All partners in academia, industry, and OGA meet for kickoff at UIC.

**TBD.** Smart City and Installation Workshop. ARL led symposium with partners U Chicago, UIUC, and Argonne towards collaborative efforts in IOBT experimentation, sensing & IOT, and Data Science.



For further information, contact:

**Mark Tschopp**  
Regional Lead, ARL Central  
US Army Research Laboratory  
[ARLCentral@arl.army.mil](mailto:ARLCentral@arl.army.mil)

## Thank you to our partners!

U Chicago, Polsky Center  
Argonne, IIT, Marquette, MCW, MSOE, NIU,  
Northwestern, Notre Dame, Purdue, RIA, UIC,  
UIUC, UW-Milwaukee, UW-Madison