CCDC ARL SOUTH
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Combat Capabilities Development Command
Army Research Laboratory (CCDC ARL) South
University of Texas at Austin
10100 Burnet Road, Bldg. 133
Austin, TX 78758

Accelerating Army Modernization

- Autonomous Networks
- Autonomy for Maneuverability
- Materials Science & Manufacturing
- Cybersecurity
- Biotechnology
- Power & Energy

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U.S. Army Soldier learns to mediate during recent mindfulness research study at Ft Sam Houston. (Photo courtesy of Dr. Valerie Rice)

ARL South

Our offices may be closed but our virtual doors remain open. Namaste….

Message from Heidi Maupin
ARL South Region Lead

Suddenly we find ourselves in a completely different world from just three weeks ago. I am reassured to know that we have already established our strong ARL South community and we can reach out to each other for support, plus many of us are already used to working in a remote manner. Now that we have no choice but to telework and maintain our distances, it's great to see everyone learning and updating our technology to effectively communicate. As a community, we will emerge from these trying times better equipped to collaborate with improved communication, ultimately leading us to rapid technology advancement.

Mindfulness can be a useful tool to help us cope during this crisis. Dr. Valerie Rice, ARL/HRED located at Army Medical Department, Ft Sam Houston, recently posted a blog on meditating during difficult times. Mindful Moments: Meditation During Difficult Times

I continue to be humbled by the gifted, talented people that I get to work with in the region. We are making much headway in building collaborations to advance Army capabilities through synthetic biology. In this issue, I highlight the efforts of Dr. Jimmy Gollihar, our lead for synthetic biology in ARL South. Jimmy is ardently working with his team at UT Austin to combat the COVID-19 virus. I also provide in this issue an introduction to stellar ARL researchers who recently joined our ARL South community.

I am often asked how we established our unique partnerships in the region. In this issue, I include a summary of the genesis of our collaboration with Uber/UT Austin/ARL.

We were recently visited by the Rapid Equipping Force Director and it was exciting to be able to show off the technologies that we've developed in the region. We've been busy hosting many events and visitors at our ARL South headquarters. With the start of 2020, I asked our visitors to write a note about what their 2020 Vision is. I've included the list of visions–I hope they all become realized!

I look forward to your recommendations regarding our collaborative effort, ideas to improve communication, and articles highlighting success through our Open Campus partnerships. ARLSouth@arl.army.mil

Researcher Recognition

Dr. Jimmy Gollihar named CTO for the Bio-Industrial Manufacturing Innovation Institute

Leading Synthetic Biology through Collaboration: ARL and our partners are on the cutting edge of synthetic biology, and one of ARL South's crown jewels is the synthetic biology collaborative research taking place in Austin, TX. Our Austin research is led by ARL South/SEDD researcher Dr. Jimmy Gollihar. Jimmy is the Biological Foundry and Synthetic Biology Lead at ARL South where he works on developing automated, high-throughput organism engineering and biological countermeasure platforms. His research focuses on the intersection of synthetic, systems, and computational biology. He is also the molecular tools lead of the Essential Research Program focusing on synthetic biology at CCDC ARL.

Jimmy has populated a 2500-square-foot ARL/UT Austin biological foundry with state-of-the-art equipment capable of high-throughput screening and directed evolution of organisms needed to manufacture materials with unique properties for Army applications. Jimmy leads efforts across five premier labs within the university and manages all external academic collaborators, graduate students, and post-doctoral researchers. In addition, Jimmy leads efforts in leveraging bioremediation and reclamation of resources technologies through our Open Campus collaboration with UT Austin.

COVID-19: As with much of our collaborative research, our expertise can be used to benefit society. The ARL South team is aggressively working with UT Austin to identify diagnostic tools and, ultimately, biological countermeasures and vaccines against the COVID -19 virus using synthetic biology approaches. Jimmy has been active in the University of Texas at Austin ecosystem and is diligently working to aid in the response effort.

Bio-Industrial Manufacturing Innovation Institute: Jimmy's reputation in this area is recognized by many. He has been appointed as the Chief Technology Officer (CTO) for the Bio-Industrial Manufacturing Innovation Institute. As CTO, Jimmy will manage the direction of research and development for the Institute. The tri-service institute was established by the Department of Defense to focus on synthetic biology for non-medical applications. Synthetic biology shows promising developments in manufacturing crucial resources more effectively than traditional manufacturing processes. The goal of the institute is to create a public–private partnership to advance domestic biomanufacturing technology and capabilities.

Jimmy is also keenly working with other government agencies as they plan the OSD Biotechnology Roadmap and embark on creating the Center for Applied Biological Engineering, whose intent is to draw all of the Army biotechnology labs under one virtual roof.

Where science fiction becomes reality: Already, Jimmy's collaborations with industry and academia have shown remarkable progress. His recent article "Supercharging enables organized assembly of synthetic biomolecules" was highlighted on the cover of Nature Chemistry and voted as cover of the year. Working closely with White Dog Labs in New Castle, Delaware, we now have biologically synthesized and can manipulate magnetesome production. These efforts will lead to advanced materials with desired magnetic properties. Jimmy is also producing melanin and other pigments in his own lab that can be used for protective coatings. These technologies have been transitioned to ARL/WMRD, ERDC, CBC, and SC for material integration and testing. By leveraging the infrastructure, expertise, and keen interest from experienced organizations across the country, Jimmy and his team are able to transform next-generation synthetic biology concepts into a scalable reality!

POC: Jimmy Gollihar
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Welcome to ARL South

Dr. Gunjan Verma is a computer scientist within ARL/CISD Network Science Division and has been with ARL for the past 10 years. Gunjan joined ARL South in Austin at the beginning of February 2020 after his division chief saw the many growing research opportunities in the ARL South region and felt it would benefit ARL to have a physical presence in this region. Gunjan will continue to support the projects he was working on while in Maryland, including the Internet of Battlefield Things research program and several research projects related to networking and machine learning. In addition, he will also be involved in new network-related projects at UT Austin, TAMU, and Rice University that have to do with trying to make Army networks more robust to adversaries and more intelligently adaptive to failures and changes in network conditions.

Dr. Jeffrey Hansberger is a research psychologist specializing in human–computer interaction for ARL/HRED. He received his B.S. in Psychology at Mississippi State University and Masters and Ph.D. in Human Factors and Applied Cognition from George Mason University. Jeff has been with ARL for 17 years and currently applies a multidisciplinary approach integrating psychology, computer science, and graphic design to enhance human performance and cognition and explore future human interfaces. He currently is leading the Human Interface Innovation (H2i) Lab at University of Alabama, Huntsville (UAH) using digital eyewear technology to experiment with new ways to visualize, interact, and present information to Soldiers. This lab and collaborative efforts with UAH began with a joint project between the US and India on ways to enhance target detection capabilities. Collaboration with UAH has included efforts with the Psychology, Computer Science, Communications, Kinesiology, and Engineering departments.

Dr. Randall Hughes is a research chemist with ARL/SEDD in Austin, Texas, with expertise in synthetic biology, protein engineering and biosensor development. Randy's research focuses on the design and application of synthetic biology tools and techniques to generate novel biosensors, materials, and assays for application to a broad array of multidisciplinary problems. Randy is establishing the Army biofoundry at UT Austin for the high-throughput design, synthesis, and screening of biological parts and materials for Army applications. Prior to joining ARL South in September 2019, Randy led the Applied Biosciences and Biosecurity Laboratory at the Applied Research Laboratories at UT Austin (a US Navy University Affiliated Research Center). Here he established the center's Gene Fabrication Facility, which is capable of high-throughput production of synthetic genes and DNA. This synthetic capability was used to support a number of synthetic biology sponsored projects conducted at UT Austin and beyond.

Dr. Thomas Scharf started his ARL Joint Faculty Appointment at University of North Texas in January 2019 in collaboration with ARL/WMRD scientists at ARL-APG. He is part of the Impact Physics Branch and Ceramic and Transparent Materials Branch. He and his group have been sintering novel monolithic ceramics and ceramic composites for Solider protection. An overarching goal of the team's effort is to determine the importance of traditional quasi-static properties like hardness, fracture toughness, and flexure/bend strength that are typically measured by ceramists when they develop and design new materials for ballistic applications. The interrelationships between these properties will hopefully provide future insight into longstanding questions about the relevance/importance of traditional quasi-static strength and toughness measurements and corresponding mechanisms.

POC: Corine Romero
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Collaborations

The Uber Story: Collaboration that was meant to be

Through Collaborative Research and Development Agreements (CRADA) between ARL and both Uber and UT Austin, we have been able to show how advantageous Open Campus can be for all partners! Already we have seen success. After only one year of our partnership, we developed and incorporated our new model for aerodynamic interaction into the Rotorcraft Comprehensive Analysis System software tool. The improved software is now used by industry and the Army Future Vertical Lift team to select proposed aircraft designs. Dr. Rajneesh Singh, ARL/VTD researcher and the lead for the Uber/UT Austin/ARL collaboration, relays how this amazing partnership evolved.

“It all started with my serendipitous meeting with Mark Moore from Uber at a conference in January 2018. Mark was primarily responsible for convincing Uber leadership to start Uber Elevate, their air-taxi. At the conference, Mark and I both attended a stacked rotor technical presentation. During a break, he and I discussed how the stacked rotor can be an enabler for quieter air-taxi vehicles operations as well as DoD's UAS applications. Mark was considering investing in this research to investigate its potential. I was able to describe our ARL's Open Campus initiative and invited his team to visit us at APG to discuss Open Campus collaboration opportunities.

“Mark and two staff members visited ARL in March 2018. My team at VTD presented to our Uber visitors our experience and capabilities in computational modeling of rotor technologies. It included access to the state-of-the-art DoD developed computational software, access to DoD's super computer hardware resources, and VTD's over 100 man-years experience in the subject matter. During this meeting, we decided to pursue a CRADA, and right then developed the CRADA scope. We agreed that ARL will be responsible for the computational modeling and Uber will be responsible for the rotor experimentation data acquisition. Mark was considering funding a private company to build the test-rig and rotor to fulfil their commitment towards the CRADA.

“Instead of funding the company, I suggested to Mark that there was an efficient alternative available through our ARL South research partner, Prof Jayant Sirohi, at UT Austin. Jayant already had a test-rig that could be used for what Uber wanted to do. Jayant had been collaborating with ARL for about five years. A week after Uber’s visit to ARL, Jayant relayed his capabilities to our Uber team. Uber was convinced that working with UT Austin was beneficial to complete the experimentation portion of the research, both for technical and financial reasons.

“VTD Director, Dr. Jaret Riddick, was as anxious as the rest of the team to start our collaboration and showed his dedication and commitment to the partnership by working closely with ARL’s Technical Transfer Office to facilitate a speedy process needed to approve the official agreement between Uber and ARL in May 2018, in about five weeks. After Uber awarded UT Austin their contract, we held a kickoff event in Austin announcing our collaborative research in August 2018.”

Team Uber/UT Austin/ARL

POC: Rajneesh Singh
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Recent Events

U.S. Army Rapid Equipping Force Meets ARL South Leading Edge Researchers

On 29 January 2020, ARL South welcomed COL Bookard, Director, Rapid Equipping Force (REF), as he met a few of our researchers to become more familiar with ARL Open Campus and ongoing research engagements with university and industry partners. REF seeks and provides immediate innovative materiel solutions to support the Army's global presence and oversees the materiel development of the future force. During his visit, COL Bookard observed a demonstration of a fully autonomous micro-drone flight, technology that was recently realized as a result of ARL and Bell collaboration. Bell representatives were present to describe their other UAS technologies that might be more suitable for consideration as "beyond the berm" capabilities.

During COL Bookard's visit, Dr. Argenis Bilbao, an ARL/SEDD researcher embedded at TTU, demonstrated his capability of wireless power transfer to a small UAV. Dr. Garrett Warnell ARL/CISD researcher located at UT Austin, discussed robotic imitation learning, Brady Butler, an ARL/WMRD researcher embedded at TAMU, presented his latest research on monolithic tungsten for kinetic energy munitions. Dr. James Paramore, ARL/WMRD located at TAMU, explained how his team has been able to dramatically improve low-quality titanium properties equivalent to high-grade titanium. Dr. Matthew Johnson (ARL/SEDD) explained the benefits of working with magnetic gears. Mr. Jonathan Wells, an ARL/SEDD PhD student at UT Austin, presented technology capable of bio-sensing and transferring power through the use of a micro film known as an E-tattoo. These technologies were highlighted in our January 2020 newsletter in greater detail.

POC: Corine Romero
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Rapid Capabilities and Critical Technologies Office (RCCTO) Innovation Days

Expert panelists recommended 12 companies to receive contracts to develop leave-behind prototypes during the Army Rapid Capabilities and Critical Technologies Office (RCCTO) Innovation Days in Austin, TX, on 11-12 February 2020. RRCTO's mission is to quickly target and acquire promising new technology. ARL scientists supported reviews and served as subject-matter experts (SMEs) on the pitch day. Dr. Ray Bateman, an ARL/CISD Army researcher embedded at UTSA, provided his expertise in defense related cybersecurity. Ray served as one of the SMEs on several panels to review promising disruptive, innovative approaches and technologies to address critical capabilities. Soldiers from 1st Cavalry division and III Corps, from Fort Hood, were on hand to provide Warfighter feedback on topics.

The focus of this event was to discover solutions that could be in the hands of Soldiers within a 1–3 year period. Technical areas that were considered include sensors, AI/ML, UAS autonomy, and cybertechnology. Prior to the event, over 750 proposals were received, of which 38 were selected for presentation at the event. Some of these companies were of specific interest to the requirements community and could inform concepts/requirements in addition to their prototyping efforts. This was the second Innovation Days event hosted by RRTCO. The next Innovation Days event is planned for summer 2020.

POC: Dr. Raymond Bateman
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Recent Events

Girl Day at UT Austin!

On 22 February 2020, thousands of K–8 girls flocked to UT Austin for one of the biggest events of the year. This year, K–12 girls spent a good portion of their Saturday trying hands on STEM activities at their own pace with the help of onsite mentors and real role models. The Engineering and Natural Sciences buildings at UT Austin filled up with hundreds of local organizations to give young girls real exposure to a possible career in science and engineering.

ARL South participated as one of the newest members of the UT Austin STEM community to help show young women how they can serve the country by helping to solve Army problems. We took this opportunity to share with the girls information about our inaugural STEM camp. This summer, ARL South will host our first week-long Gains in Engineering, Math and Sciences (GEMS) program. We will focus on artificial intelligence and machine learning (AI/ML) for vehicles.

Dr. Valerie Rice (ARL) and Ms. Angela Jeter (Fort Sam Houston) joined Ms. Heidi Maupin and Ms. Corine Romero (ARL South/Austin) for the event. Valerie and her team have been investigating meditation and complimentary health care (meridian-based practices—energy psychology in which you tap certain places on your body to relieve stress, etc.). The team chose an activity to help show the ways in which mindful techniques can help reduce stress.

POC: Corine Romero
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UTEP/UTSA Cybersecurity Workshop

The ARL South Cybersecurity teams at UTSA and UTEP hosted a successful cybersecurity workshop on 5 March 2020 at UTSA. Drs Raymond Bateman and Kristin Schweitzer are Army researchers embedded at UTSA and worked with Army researcher, Dr. Jaime Acosta (embedded at UTEP) on establishing a cybersecurity workshop where students from both schools could work together on identifying and remediating security threats our nation faces. Not only does our collaboration with students during these events provide a direct pipeline to attract talented future leaders for Army, they provide actual data that our researchers incorporate into existing technologies to improve our cyber defense posture.

POC: Jaime Acosta
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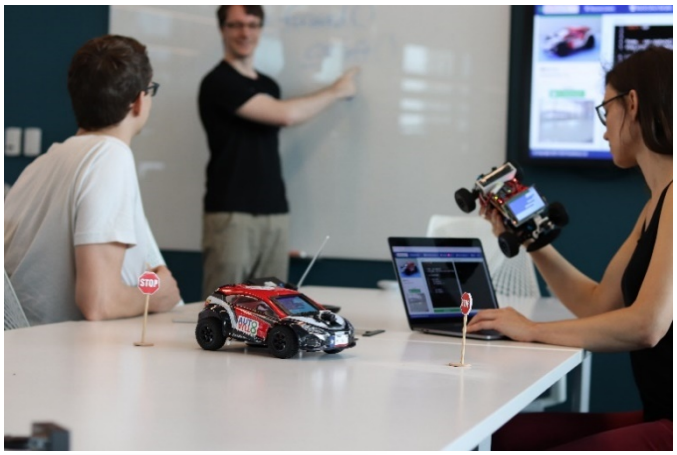
Upcoming Events

Gains in the Education of Math and Science: GEMS



ARL South will partner with Revision Ed, a firm specializing in creating STEM curricula, to host our Inaugural GEMS summer STEM event. Rising 9th, 10th, and 11th graders will investigate principles of Autonomy, Machine Learning, Computer Vision, and Public Policy through a series of team-oriented STEM activities. Students will be introduced to the importance of these principles and how they are required as we modernize Army technologies. Our aim is to engage students early in the exciting world of autonomous robots to increase and grow a leading field of experts in the science of autonomy. On the final day of this event, the students will participate in an autonomous navigation challenge using the vehicles programmed throughout the week by the students.

Important Dates

February 1, 2020
Student Application Opens

April 30, 2020
Student Application Closes

June 22-26, 2020
Program Dates

ARL South is now accepting applications for rising 9–11th grade students, Near Peer Mentors, and Resource Teachers interested in joining us for the first annual **ARL South GEMS program**. Please visit our site for more information.

Upcoming Events

Many events have been canceled due to the COVID-19 crisis, others are pending.

June 22-23, 2020—Viable Product Evaluation Day, RELLIS, College Station, TX
Details pending

June 22-26, 2020—ARL South GEMS Program
https://www.usaeop.com/program/austin/

November 2-5, 2020—25th International Command and Control Research and Technology Symposium (ICCRTS), Southampton, UK
POC: David Alberts, dalberts@ida.org

Acronym Relief

Combat Capabilities Development Command (CCDC) Acronyms

- Combat Capabilities Development Command Soldier Center (CCDC SC) , formerly Natick Soldier Research, Development and Engineering Center (NSRDEC)
- CCDC Aviation & Missile Center, formerly Aviation & Missile Research, Development and Engineering Center (CCDC AMRDEC)
- CCDC Army Research Laboratory (CCDC ARL), formerly Army Research Laboratory
- CCDC Data & Analysis Center (CCDC DAC), formerly Army Material Systems Analysis (AMSAA), Survivability/Lethality Analysis Directorate (SLAD), and Human Systems Integration (HIS)
- CCDC Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, and Reconnaissance (CCDC C5ISR), formerly Communications-Electronics Research Development and Engineering Center (CERDEC)
- CCDC Ground Vehicle Systems Center (CCDC GVSC), formerly Tank Automotive Research Development and Engineering Center (TARDEC)
- CCDC Armaments Center (CCDC AC), formerly Armament Research, Development and Engineering Center (ARDEC)
- CCDC Chemical Biological Center (CCDC CBC), formerly Edgewood Chemical Biological Center (ECBC)
- Army Research Office (ARO)
- ARL/CISD: Computational & Information Sciences Directorate
- ARL/HRED: Human Research & Engineering Directorate
- ARL/SEDD: Sensors & Electron Devices Directorate
- ARL/VTD: Vehicle Technology Directorate
- ARL/WMRD: Weapons & Materials Research Directorate
- OSD: Office of the Secretary of Defense

University/Partner Acronyms

- AMEDDC&S - Army Medical Department Center and School
- SCI - Smalley Curl Institute (Rice U)
- TAMU - Texas Agricultural & Mechanical University (Texas A&M University)
- TTU - Texas Tech University
- UAH - University of Alabama, Hunstville
- UNM - University of New Mexico
- UNT - University of North Texas
- UTA - University of Texas at Arlington
- UT Austin – University of Texas at Austin
- UTD - University of Texas at Dallas
- UTEP - University of Texas at El Paso
- UTSA-University of Texas at San Antonio

Visitors

The new year brings many new and exciting possibilities with it, so we asked ARL South what their 20/20 vision was for 2020. Here are some of the responses.

Continual improvement
Clarity
Teamwork
Robots! Robots! Robots!
Selfless love
Life saving technology
Clear Vision
Purpose
Integrated Vision
Automated domination
Collaboration

Positive change and growth
Better together
Communicate
Understanding/clear communication
Intersections
Clear the static
Stay true to science and impact
Clean world
Kindness to animals
A purposeful path
Endless opportunities for NGCV

Hybrid AM Team

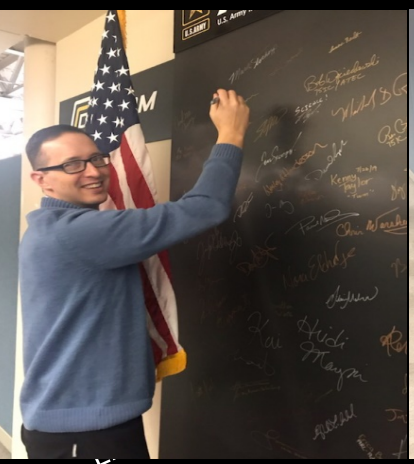
Open Campus Region Leads

Dr. Patrick Baker, Director for CCDC ARL

Jeff Nesta, WMRD, CCDC ARL

Dr. Gunjan Verma, CISD, CCDC ARL

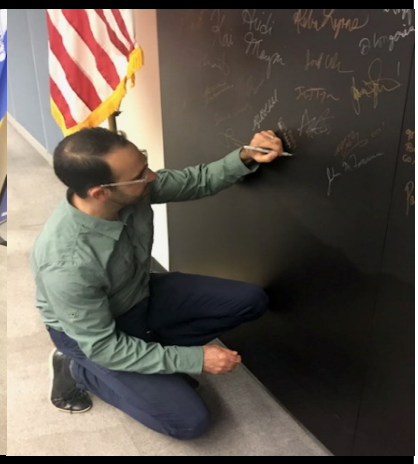
Erica Brady, Security Technician, CCDC ARL



Mark Tschopp. ARL Central

Rob Jensen, ARL Northeast

Karl Kappra, Chief for the Office of Strategy Management



Peter Khooshabehadeh, ARL West