

# Defense Autonomy

## News

Connecting You to Your  
Community of Interest



## Delivery at the Speed of Relevance

*As strategic competition between nations creates new threats to our national security, our efforts in autonomy research must directly contribute to the speedy delivery, deployment, and use solutions of enabling technologies to address mission needs. The Autonomy Col recently launched an ambitious effort to support that goal.*

The clarion call and imperative issued in the 2018 National Defense Strategy (NDS) is that the chief threat to U.S. security and prosperity is the reemergence of long-term, strategic competition between nations. The imperative of this new reality that arises in this context is that the transforming character of warfare necessitates those in the profession of arms to consider new ways of doing business.

One such area that requires fundamental change is the speed at which science and technology research initiatives result in validated and reliable weapons systems. Here there exist three core aspects: speed, direction, and deployment. The NDS calls this "delivery at the speed of relevance." This means that our efforts in autonomy research should directly contribute to the speedy delivery, deployment, and use solutions

of enabling technologies to address validated and relevant mission needs.

The age of platform-based technologies has ushered in the likes of Google, Amazon, and Facebook; with their enabling technologies, these companies have transformed how the world thinks, does commerce, and interrelates. In the case of Facebook, the axiom “from dorm room to boardroom” (where code developed by college students quickly makes its way into corporate America) would communicate how the conceptualization and design of a technological enabler was brought to market to rapidly fill a validated need. Given the vast pool of brain capital embodied in today’s youth—who often possess the capability to identify a need and write a software that transforms into a deployed, tangible, interactive solution in a matter of days or weeks—an axiom of “dorm room to deployment” may be one reality that the DoD must prepare and build infrastructure for. More specifically, those of us who are occupied with autonomous systems’ design, development, and deployment must be prepared to offer “on ramps” for nontraditional researchers to contribute techniques and technological artifacts that contribute to our ultimate objectives.

In recent months, the Autonomy Col kicked off an ambitious effort—the creation of a common development environment: the Simulation, Evaluation, Analysis, and Testing (SEAT) environment. SEAT is intended to meet the NDS “delivery at the speed of relevance” need by combining the capabilities of Continuous Integration, Continuous Deployment, Continuous Authority to Operate (CI-CD-CATO) with robust modeling and simulation (HLA-Compliant) and prototype software cloud-based plug and play for capability. In this way, traditional and nontraditional researchers and innovators can bring their nascent autonomy technologically to meet high-fidelity simulated mission set for rapid test, analysis, and maturity.

In the coming months, you will be hearing more about SEAT. We hope you in the community can contribute your ideas to this development effort.

—Nicholas Kasdaglis, PhD, The MITRE Corporation  
([nkasdaglis@mitre.org](mailto:nkasdaglis@mitre.org))

## Message from the Steering Committee



I have been the Autonomy Community of Interest (Col) Lead for about seven months, and I have been impressed with the quality of autonomy work and efforts by the Col members to coordinate autonomy S&T efforts across DoD. There have been some exciting developments in autonomy over the last few years, and I am interested to see how they will translate into new capabilities to improve the performance of our warfighters.

I look forward to seeing many of you at the Autonomy Workshop in Boston on May 16–17 so that we can begin to address the ethical issues involved with the use of autonomy in Defense applications, plus start to map out a “road to dominance” for DoD autonomy over the next few years.

Thank you to all the Col members who have helped me settle into my new role. I look forward to working with more of you in the coming months.

Please provide us with feedback as to the usefulness of this newsletter in generating interest in the Autonomy Col, and let us know if you have some content to provide for future editions.

—Jean-Charles (JC) Ledé, AFRL Autonomy Technical Advisor, DoD Autonomy Community of Interest Lead

## Autonomy in the News

### [Solving One of the Hardest Problems of Military AI: Trust](#)

DoD is rolling out new strategies, partnerships, organizations, and budgets to develop artificial intelligence (AI) technology for military uses. But the agency's success may hinge in part on overcoming the massive gaps in trust around AI. This challenge of trust is particularly acute in the military, where commanders—or even the machine itself—may have to make life-and-death decisions on the basis of information provided by an AI-enabled system. The U.S. government's ability to harness AI for national defense may also rely on its ability to successfully foster trust with the American public, the private sector, and foreign governments. This [article](#), published by *Defense One*, provides more insight on that topic.

### [R2-D2 in the Cockpit? Air Force Testing "Skyborg" AI Program](#)

In the near future, an Air Force pilot's wingman could be flown by artificial intelligence. But the service wants to take the concept even further, with an AI plane that trains with its pilot, acting as a sidekick. In short, it's R2-D2 from "Star Wars" in an aircraft of its very own. Welcome to Skyborg, an Air Force Research Lab program aimed at pairing AI with a human in the cockpit so the machine can learn how to fly. For more on this topic, read the full article, published by *DoD Buzz*.



## Events

### Ethical and Technical Challenges of Autonomy Workshop

**May 16, 2019**

**7:30 a.m. to 12:30 p.m.**

Federal Reserve Bank of Boston, Morris Auditorium, 600 Atlantic Avenue, Boston, MA

The Autonomy Community of Interest is hosting a workshop on the Ethical and Technical Challenges of Autonomy. The goal is to examine the implementation and implications of the 3000.09 Directive on autonomous weapon systems; discuss the legal, moral, and ethical considerations for these systems; and explore the challenges around the test evaluation validation and verification for such systems. Please register [online](#) (for registration password, contact Marissa McCoy, [jmccoy@mitre.org](mailto:jmccoy@mitre.org)).

Collocated Events: This workshop is collocated with the [Air Force Techstars](#) Demo Day (afternoon of May 16) and an Industry Engagement Day for nontraditional industry (May 17). Links to register for these additional events can be found in the registration website provided above.

POC: **Marissa McCoy**, [jmccoy@mitre.org](mailto:jmccoy@mitre.org)

### Air Force Techstars Demo Day

**May 16, 2019**

**(afternoon)**

Federal Reserve Bank of Boston, Morris Auditorium, 600 Atlantic Avenue, Boston, MA

The Air Force Techstars Demo Day is your opportunity to hear company pitches and get a first look at industry-changing technologies around autonomous systems, artificial intelligence, data-enabled recruiting, and training and education systems. You'll meet founders, network with the autonomy community, and see firsthand how the Air Force is accelerating innovation and delivering capabilities closer to state-of-art for the warfighter. Please register [online](#) (for registration password, contact Marissa McCoy, [jmccoy@mitre.org](mailto:jmccoy@mitre.org)).

POC: **Marissa McCoy**, [jmccoy@mitre.org](mailto:jmccoy@mitre.org)

## Researcher in Focus



### Christopher M. Kroninger

*Robotics and Autonomy Team Leader, Convergence of Lethality, Protection & Autonomy to Dominate Ground Combat Program, Combat Capabilities Development Command (CCDC) Army Research Laboratory (ARL)*

**Area of Focus/Key Interests:** Autonomous unmanned aircraft system (UAS) technologies, distributed and collaborative intelligent systems, and layered defense incorporating many coordinated heterogeneous agents in adversarial environments.

**Current Work:** Kroninger leads a team that strives to enhance ground combat through the use of robotics and autonomy. Motivating scenarios include a conception of the survivability "onion," i.e., layered defense, incorporating many coordinated agents as

well as area coverage in an adversarial environment. Major threads of research focus on (1) the selection and deployment of teams of heterogeneous agents, (2) coordinated movement over large areas to elicit and identify threats, and (3) single agent autonomy to enable robust navigation and movement in low-cost robotic systems. Recent efforts examine mission-to-feature matching algorithms for assembling teams that achieve desired probabilistic likelihood of mission success. Additional work develops optimal trajectory control policies for an engagement model initially formulated as a differential two-player game (a defender versus an intruder) and extending such work to multi-agent games operating on a 2D surface perimeter.

In addition, Kroninger serves as the government Research Area lead for the Heterogeneous Group Control Research Area within CCDC ARL's Distributed and Collaborative Intelligent Systems and Technology Collaborative Research Alliance and is the lead for CCDC ARL's efforts in Intelligent UAS Teaming Technologies in support of the Future Vertical Lift Advanced Teaming program.

**Message to the Col:** Seek collaborators with interests or solution for low size, weight, and power plus cost (SWaP-C) radios and approaches for networking, low SWaP-C novel sensors for navigation or adversary signature (RF/EM, thermal, etc.), and novel robotic platforms.



## Events

### DoD Technical Exchange Meeting on Computing at the Edge

**May 30, 2019**

Basic Research Innovation and Collaboration Center (BRICC), 4100 North Fairfax Drive, Suite 450, Arlington, VA

The DoD Col working groups are pleased to announce the Technical Exchange on Computing at the Edge, to be held May 30 in Arlington, VA. The goals of this meeting are to (1) bring together scientists and engineers from across DoD to discuss current status, future directions, and requirements of computing at the edge for DoD applications; (2) exchange ideas and best practices in constantly changing computing research and technologies and associated software; and (3) explore and define common computing environments across DoD for seamless integration. The meeting will feature briefings, panel discussions, and interactive poster sessions to foster working-level collaborations.

**Participation:** DoD federal employees only. Participants are required to submit the following by May 20:

- An abstract, not to exceed 500 words, summarizing relevant computing-at-the-edge research, development, and engineering activities. Also, please include assets, capabilities, and requirements that are pertinent to this theme, and
- A corresponding poster (28" X 38" in PowerPoint or pdf format)

**POC:** Raju Namburu via Dr. Charles Havasy: [chavasy@mitre.org](mailto:chavasy@mitre.org).

### Efficient & Robust Machine Learning Center of Excellence Technical Interchange Meeting

**June 5, 2019**

University of Wisconsin, Madison

The AFRL Efficient and Robust Machine Learning Center of Excellence (ERML COE) is hosting a Technical Interchange Meeting (TIM) on June 5. The purpose of the TIM is to bring together COE university researchers with DoD government researchers, scientists, and engineers to foster a collaborative research environment through invited speakers, academic-government panels, and joint COE-DoD research poster sessions.



**POC:** Alvaro Velasquez via <https://www.wpafb.af.mil/AFRL/>

**Registration:** Registration and tentative agenda information is available [here](#).

### Autonomous Systems Test and Evaluation (T&E) Workshop

**June 26–27, 2019**

Scobee Auditorium, Air Force Test Pilot School, Edwards Air Force Base, CA

This workshop is in support of the AFTC strategic goal to shape future test capabilities to maximize warfighter lethality. This forum will discuss current practices, developmental activities, capability gaps, operational trends, and lessons learned in the field of autonomy. Inputs from this event will be codified in an Autonomous System T&E Handbook to create a reference of best practices in testing autonomy for the T&E Enterprise.

**POC:** Interested in participating? Contact **Maj. Kyle Bergren** or **Capt. Riley Livermore** via <https://www.edwards.af.mil/Units/USAFTPS/>.

## Announcements

### Call for Posters: Efficient & Robust Machine Learning Center of Excellence Technical Interchange Meeting

The AFRL Efficient and Robust Machine Learning Center of Excellence (ERML COE) team invites all government researchers and engineers to submit a poster on their ML research, project, or application for presentation at the ERML COE Technical Interchange Meeting on June 5. The ERML COE is seeking posters in the areas of data efficiency, computational efficiency, operational robustness, and adversarial robustness. The deadline for poster and abstract submissions is May 15.

**POC: Alvaro Velasquez** via <https://www.wpafb.af.mil/AFRL/>

### Launched: AFOSR Center of Excellence in Assured Autonomy in Contested Environments

The Air Force Office of Scientific Research (AFOSR) Center of Excellence in Assured Autonomy in Contested Environments is scheduled to kick off on May 13 at an event at the University of Florida. This effort, which has secured \$6 million in funding for the next six years, includes partnerships with the University of Florida, Duke University, the University of Texas at Austin, and the University of California at Santa Cruz. Ten principal investigators (PIs) at these four universities will be pursuing research projects on:

- Modeling and Analysis Methods for Nonsmooth Systems
- Adaptation, Optimality, and Synthesis
- Analysis, Design, and Control Synthesis Within and Over Networks
- Design and Analysis with Asynchronous Information
- Attack-Resilient Design
- Protecting Safety- and Mission-Critical Information

**POC J. Willard Curtis** via <https://www.wpafb.af.mil/afri/afosr/>

### Squad X Demonstrates Autonomous Urban Clearing Behaviors

In February/March 2019, Squad X's ASSAULTS system demonstrated autonomous urban clearing behaviors at 29P in Experiment 2. Marines demonstrated coordinated reconnaissance and support by fire for vulnerable approach with autonomous movement of UGVs and UAS; exploited through wall radar simulation to improve methods of detecting threats out of one- to two-story buildings; exploited multi-sweep radar surveys to develop not just threat location but also movement to tailor their maneuver and fires to engage on advantageous terms; and pushed through moderately dense terrain while selectively isolating and bypassing or eliminating stubborn threats.

**POC: LTC Philip Root**, DARPA/TTO, [www.darpa.mil](http://www.darpa.mil)

### Squad X's BEAM Squad System Detects and Defeats Targets at Extended Ranges

In March 2019, Squad X's BEAM Squad System (BSS) successfully detected, defeated, and geolocated a variety of targets at extended ranges in its Experiment 3. The BSS expanded its node dispersion by using an experimental Long-Range Puma carrying a mesh radio payload. Further experimentation demonstrated using multiple Airborne-BEAMs in conjunction with the unmanned ground vehicle BEAM Super Node to locate targets with support from Squad X transition partners.

**POC: LTC Philip Root**, DARPA/TTO, [www.darpa.mil](http://www.darpa.mil)

### MFP Demonstrates Autonomous Detection, Discrimination, Interceptor Assignment, IFTU, and Engagement

Mobile Force Protection (MFP) demonstrated autonomous detection, discrimination, interceptor assignment, In-Flight Target Update (IFTU), and engagement at Yuma Proving Ground (YPG) in March 2019.

**POC: LTC Philip Root**, DARPA/TTO, [www.darpa.mil](http://www.darpa.mil)

## URSA Kicks Off with All Performers

In February 2019, Urban Reconnaissance through Supervised Autonomy (URSA) kicked off with all performers. Soar Technology, Inc., Scientific Systems Company, Inc., and SRI International are the Track A performers. The Charles Stark Draper Laboratory, Inc. is the Track B performer. Track A is focused on system-level solutions and demonstrations, and Track B is focused on compelling critical enabling capabilities, such as component-level algorithms, behavioral analysis techniques, and technologies that could enhanced multiple system-level approaches.

**POC: LTC Philip Root**, DARPA/TTO, [www.darpa.mil](http://www.darpa.mil)

## ONR Announces Science of AI Program

The Office of Naval Research (ONR) recently kicked off the Science of Artificial Intelligence (AI) program, which will conduct fundamental research to develop the science base and computational methods for building versatile intelligent agents (physical and cyber) that can perform a variety of tasks in uncertain, unstructured, open-world environments with high-level instructions, collaborating seamlessly with humans and other agents. The initial three topics for the program are: (1) integration of domain knowledge and machine learning, (2) artificial intelligence in support of collaborative complex decision-making, and (3) decentralized perception and planning in dynamic environments.

**POC: Marc Steinberg** via <https://www.onr.navy.mil/>

## ONR Holds MURI Program Review

In April, ONR held a program review of a Multi-Disciplinary Research Initiative (MURI) conducting fundamental research in formally provable/high-confidence human interaction with autonomous and learning systems. Universities supporting the MURI include the University of California Berkeley, Stanford University, and the University of California Los Angeles.

**POC: Marc Steinberg** via <https://www.onr.navy.mil/>

## AFOSR Launches MURI on Control-Oriented Learning

In October 2018, AFOSR started a MURI on verifiable, control-oriented learning on the fly. This effort will conduct fundamental research to develop a theoretical and algorithmic foundation for run-time learning and control for physical, autonomous systems.

**POC: Frederick Leve**, [dycontrol@us.af.mil](mailto:dycontrol@us.af.mil).

## ARL Holds Program Review for DCIST

In April, the Army Research Laboratory (ARL) held a program review for the Distributed and Collaborative Intelligent Systems and Technology (DCIST) Collaborative Research Alliance. The DCIST Program conducts fundamental and applied research to understand how large, heterogeneous teams of intelligent systems and soldiers can operate together in complex, unstructured environments.

**POC: Brett Piekarski** via <https://www.arl.army.mil/www/default.cfm>

## Autonomy Research Collaboration Network Is Launched

The Air Force Research Laboratory (AFRL) is pleased to announce the creation of ARCNet—the Autonomy Research Collaboration Network. ARCNet is a consortium for conducting autonomy technology R&D activities. Any organization (industry or university) interested in working with AFRL on autonomy R&D is encouraged to join ARCNet. You can apply for membership [here](#). The administrator for ARCNet is the [Strategic Partnership Global Institute](#) (SPGI). SPGI can be contacted through its [website](#) or at 937-829-5661. AFRL strongly encourages interested organizations to contact SPGI and join ARCNet. For further information, please contact **Corey Schumacher** at SPGI (937-829-5661 or [online](#)).

### Don't Miss an Issue!

Interested in receiving an electronic copy of this newsletter? Please email **Dr. Charles Havasy** of The MITRE Corporation at [chavasy@mitre.org](mailto:chavasy@mitre.org), and we'll add you to our distribution list.