



2019 Ethical & Technical Challenges of Autonomy Workshop Quick Look Report

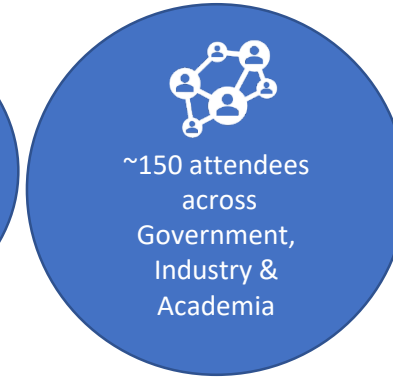
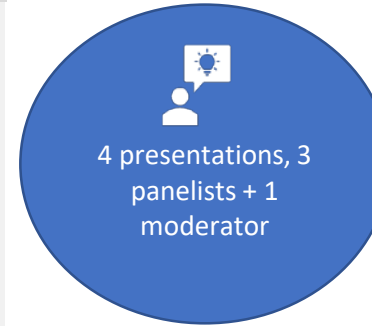
Event Description

As progress is being made on the development of autonomous systems, challenges and questions associated with the deployment of these systems is also growing. How autonomy will be implemented and executed, in which situations, and with what oversight, are all questions that are currently being considered by the autonomy community.

On 16 May 2019 in Boston, MA, the Autonomy Community of Interest (COI), a community of autonomy researchers established under the Under Secretary of Defense (Research & Engineering), hosted a first of its kind workshop for Government, industry, and academic autonomy practitioners and developers on the Ethical and Technical Challenges of Autonomy (ETCA).

The workshop was collocated with the Assistant Director for Autonomy Industry Engagement Day and the Air Force Accelerator Powered by Techstars Demo Day.

ETCA 2019 Participation / Engagement



ETCA Workshop Highlights

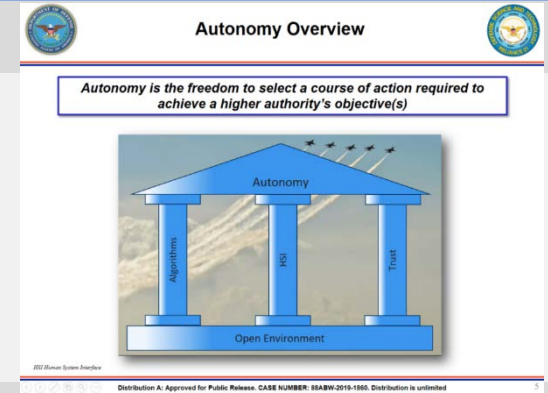
- Attendees from U.S. Military, Academia, and Industry and Allied Nations
- Excellent audience participation and influence occurred through real-time social media polls and Q&A
- Both Ethical perspectives and Technical issues were considered, along with their interactions such as the use of ethically constructed MS&A environments for AI machine learning
- The delegation of authority through a chain of command is customary doctrine. What the 21st century brings is the human delegation of autonomy to trusted & trained machines, and their subsequent agents.
- The community was challenged to enter the ethical debate with rigor and consideration for future capabilities that could become necessary in the defense of the Nation.
- Technologists should take care to avoid confusing the potential application of acceptable weapons in an unethical manner (e.g. improper targeting) with the development of inherently unethical weapons (e.g., chem/bio).

WORKSHOP TOPICS



ETCA Workshop Presentation & Panel Highlights

Autonomy Framework and Challenges



JC Ledé, AFRL Autonomy Technical Advisor / Autonomy Col Lead

- Autonomy is delegated by the chain of command, either to a human or to a machine, but significant consideration must be given to proper restrictions of the authority of machines and to downstream delegation from machine to machine.
- Autonomy Col should engage in the public debate over use of autonomous weapon systems, and shape the message regarding potential for safer, more effective human decision-making.
- Autonomy Col should consider a future workshop to develop an Ethical Framework for Decision Making including a potential extreme case where humans lose free agency of their decisions.

Autonomy & Weapon Systems (DoD 3000.09): Overview and Implications

Dr. Jason Stack, Portfolio Manager for Autonomy, Office of Naval Research

- The Law of War governs the ethical & legal use of all weapons of war.
- DoD Directive 3000.09 provides additional guidance for autonomous systems and is often misunderstood.
- 3000.09 does not categorically prohibit lethal autonomy, but requires an additional level of review. To date no system has gone through the 3000.09 review.
- To prepare for emerging technologies, the community must collaboratively pursue additional clarification to ensure the development and employment of autonomous weapons systems remains legally and ethically consistent.

Test, Evaluation, Validation, and Verification (TEVV) of Autonomous Systems

Dr. Craig Lennon, Army Research Laboratory

- Focus should be placed on risk analysis and mishap scenarios in autonomy TEVV.
- We need technologies supporting effective human supervision of autonomy during development and after fielding.
- TEVV must ensure that autonomous systems are secure, supervised, and safe.
- Technical challenges include supervision, generalizability, safe learning, teaming, training data, simulation, and design for easy verification/certification.

Urban Reconnaissance through Supervised Autonomy (URSA) Ethics Panel

LTC Phil Root, Acting Deputy Director, DARPA Tactical Technology Office; Col Jim Cook, Head of Department of Philosophy, USAFA; COL David Barnes, Deputy Head of department of English and Philosophy, USMA; Mr. Brian Williams, Institute for Defense Analyses

- DARPA URSA is exploring ethics, privacy, human situational awareness, and responsibility when AIs discern non-combatants and engage combatants.
- The ethical restriction of autonomy in lethal engagement should not be assumed as a disadvantage in the face of adversarial use of lethal autonomy. Strategic, operational and tactical analysis of the actual disadvantage (or advantage) is necessary.
- The view of Artificial Intelligence as a partner to a human (vs a tool) is important, as humans have demonstrated a strong proclivity to protect and preserve partners.



ETCA Workshop Audience Participation & Key Takeaways

Slido Polls

<p>Which topic(s) would you like an additional Working Group to address? (Select all that apply)</p> <ul style="list-style-type: none"> ➤ AI / Machine Learning – 67% ➤ Open Environment – 37% ➤ Test Infrastructure – 47% ➤ Trust & Ethics – 56% 	<p>What topics would you like to see addressed in future events?</p> <ul style="list-style-type: none"> ➤ Ethics, trust, and privacy ➤ AI, Autonomy, Machine Learning ➤ Human-Machine Teaming ➤ Hardware & Sensors ➤ Modeling & Simulation / Open Environment ➤ Data, synthetic data, scalability, declassification of data 	<p>How do we grow the Autonomy Col and increase its impact?</p> <ul style="list-style-type: none"> ➤ Greater partnerships and engagements with entrepreneurs and academics via workshops and outreach ➤ Communicate: information sharing via newsletter/Twitter; track impact of input and value add on contributions ➤ More engagement with service colleges (e.g., NWC, Army JAG School) ➤ Share problem sets, datasets, and algorithms ➤ Establish and maintain drumbeat 	<p>What short/mid/long term challenges should DoD tackle?</p> <ul style="list-style-type: none"> ➤ Short: Streamline 6.1-6.4 contracting mechanisms; intelligence augmentation for autonomy/testing environments; spend more time defining and disseminating problems of interest/CONOPS; fix perception of DoD autonomy use and enable collab with industry leaders (not defense industry) ➤ Mid: Better transparency with industry of datasets & requirements to steer IR&D; train & educate all DoD on tech challenges & ethical dilemmas of AI; inspire next gen to join or support DoD; retain top DoD talent by creating culture that values them; develop ethical frameworks ➤ Long: Discoverability of Col activities for larger industry interests; AI for autonomy
<p>Should we collocate future Autonomy Col events with other large conferences?</p> <ul style="list-style-type: none"> ➤ 68% Yes; 32% No <p>Which conferences or events?</p> <ul style="list-style-type: none"> ➤ ICRA, IROS, RSS, HRI, AAI, AUVSI ➤ Robotics Conferences ➤ DARPA, NGA conferences 			

Key Takeaways

- DoD Directive 3000.09 provides additional guidance for autonomous systems and is often misunderstood. Reaching the autonomy/lethality status is not necessarily prohibited, but requires an additional level of review. The current effort is not necessarily to revise it, but to provide a supplement that can provide clarification and implementation instructions. To date no system has gone through the 3000.09 review.
- The Autonomy Col should include in its upcoming Charter re-write, a function to engage in the public debate concerning use of autonomous weapon systems. The expertise of the COI should help provide the technical context regarding the potential for safer, more effective human decision making.
- As the community addresses and removes critical roadblocks, researchers should consider future warfighting outcomes that will arise as a consequence of autonomous weapon systems.
- DARPA Urban Recon & Surveillance with Autonomy (URSA) is exploring ethics, privacy, human situational awareness, and responsibility when AIs discern combatants from non-combatants. A scalable test range is needed. Concerns raised include the preservation of human decision making skills when humans are rarely tasked to make them.
- Human inputs must be evaluated as beneficial, irrelevant, detrimental, or possibly illegal. Research suggest humans trust AI more when it makes human-like mistakes vs bizarre, inexplicable mistakes. Little research is available about when AIs should trust or not trust the human input.

Next Steps

- Select and define topics for a series of future workshops; topics under consideration include: M&S (from physics based systems to realistic environments for single systems to full war gaming simulations with many systems; moving between various simulation tools), Scalable Teaming (existing efforts and future visions across the services).
- Autonomy Col exploring the integration of additional Working Groups/topics, which could include the legal and ethical dimensions of forming and maintaining trust as it relates to TEVV, AI/ML that would focus on data collection, curation, protection, and foundational elements of AI/ML rather than application (e.g., secure AI research), and/or a working group focused on open architectures / open environments.

ETCA Workshop Schedule

“Thanks for organizing the workshop and inviting me. It was very interesting and heartening that people are working on this issue.”

-Industry Participant



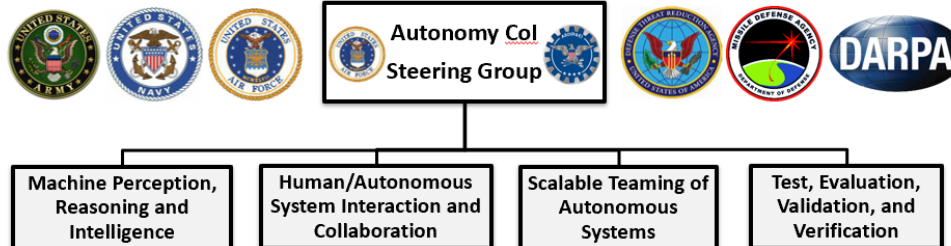
7:00am-8:00am	Registration	A collaborative space with discussion topics is provided, allowing participants an opportunity to share thoughts and contribute to the conversation.
8:00am-8:30am	Autonomy Framework and Challenges	Mr. JC Lede, Autonomy Col Lead and AFRL Autonomy Technology Advisor, provides an overview of the Autonomy Community of Interest and introduces the topics of the workshop.
8:30am-9:15am	Autonomy & Weapon Systems (DoD 3000.09): Overview and Implications	Dr. Jason Stack, Portfolio Manager for Autonomy at the Office of Naval Research, overviews the key tenets of the DoD policy, poses some of the critical questions for consideration, and engages the attendees in a dialogue concerning what proactive roles the technical community needs to take to ensure ethical consistency with emerging autonomous and intelligent technologies.
9:15am-10:15am	Urban Reconnaissance through Supervised Autonomy (URSA) Ethics Panel	LTC Phil Root, Acting Deputy Director of the Tactical Technology Office (TTO) at DARPA, provides an overview of URSA, a DARPA program whose vision is to develop autonomous technology to rapidly discriminate hostile intent and identify threats. LTC Root also moderates an ethics panel comprising members of a working group developing a legal, moral, ethical framework to navigate autonomous system development and employment.
10:15am-10:45am	Break	A collaborative space with discussion topics is provided, allowing participants an opportunity to share thoughts and contribute to the conversation.
10:45am-11:30am	Test, Evaluation, Verification, and Validation (TEVV) of Autonomous Systems	Dr. Craig Lennon, ARL, discusses a potential avenue for conducting Test, Evaluation, Verification & Validation of autonomous systems teaming with humans and the research needed to support this. This presentation is intended to generate feedback and interest in preparation for a follow-on workshop.
11:30am-12:30pm	Audience participation	The audience is invited to comment, provide suggestions, and ask additional questions to the presenters, in person or using an online collaboration tool.
12:30pm-1:00pm	Lunch Break	
1:00pm-5:00pm	Techstars Demo Day	Air Force Accelerator Powered by Techstars Demo Day is collocated and requires separate registration.



Autonomy Col Organization



The Autonomy Col's purpose is to advance autonomous systems by assessing Science & Technology investments, gaps, and opportunities, and initiating critical enabling technology development.



The purpose of the Working Groups is to **catalyze and enhance the autonomy community of DoD S&Es** for the purposes of building collaborative research connections, identifying advancing common technology interests and goals, and informing and mentoring the autonomy workforce.

Membership of Autonomous Systems Col is **open to anyone** who is working in the areas of Autonomy and is within the DoD workforce—either military, civil servant, or contractor.