

# THE SIREN



A Science and Technology Directorate Newsletter for First Responders

Summer 2018

## S&T and NASA JPL Train AI Tool, AUDREY to Help Firefighting



As humans, if we see a ball coming towards us, we can move our hand in certain way to catch it. To teach a machine do that is tricky because it doesn't know what a ball is or know how to move. "There is this new science of being able to give a whole different set of data to a robot, i.e., what a ball looks like and how fast it is moving, so it can try to catch it. If it fails, it will learn from that experience and do something different. Over time, it will become perfect. We learn from behavior and improve outcome each time," said James Mullins Ph.D. of Deakin University in Melbourne, Australia. Dr. Mullins and his colleague Sameer Deshpande were among the scientists, firefighters and technology developers who participated in S&T's high energy test burn to collect real-time fire data to train the [Assistant for Understanding Data through Reasoning, Extraction and sYnthesis \(AUDREY\)](#) system to help first responders.

AUDREY is a technology developed as part of NASA's mission for deep space exploration and it leverages capabilities from a field of artificial general intelligence. It is designed to determine what data is important for the responders to have in order to perform their duty quicker to save lives and property, while they stay safe themselves. But like a real human being, AUDREY as an AI system, needs to be taught what set of data to prioritize under different scenarios.

Hosted by Cosumnes Fire Department in Sacramento, California, firefighters set up real fire scenarios to show the scientists and tech developers what a realistic fire behavior is and how firefighters respond to it in three different settings. First, an empty container with materials such as wood and paper was set on fire. The second model was a garage fire caused by crude oil. The third was a house fire with real furniture. Each model aimed to teach AUDREY how fast a fire develops, how the content of the fire affects the heat, how fast the heat rises, and how much time a responder has to do his/her job before it is no longer survivable. The fire data was collected using low-cost thermal sensors, 3-D and 360 degree cameras. The heat and gas measurements taken from different heights inside the rooms were logged and recorded in near- real time.

"This is a great opportunity for us at NASA JPL. We don't have training data at NASA. To make this system smart in firefighting, we need to learn its environment," Dr. Ed Chow of NASA JPL said.

S&T is aiming to have a prototype ready for firefighters within the next 12-18 months. The testing and data capturing was made possible with the contributions of Deakin University in Australia, Flaim Systems, Qwake Technologies, Signal Garden, W.S. Darley & Co, Exponent Consulting, and Reax Engineering.

### In This Issue:

*S&T and NASA JPL Train AI Tool, AUDREY to Help Firefighting*

*S&T Develops the First Line of Defense Against Acts of Targeted Violence*

*S&T Presents Public Safety Capabilities at APCO Conference*

*S&T Field Tests ADRAS, New Roadside Safety Technology*

*S&T and the International Forum to Advance First Responder Innovation (IFAFRI) Partner to Spur First Responder Technology Innovation*

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## S&T Develops the First Line of Defense Against Acts of Targeted Violence

Since 2010, the U.S. government has invested more than \$20 million into understanding all forms of radicalization to violence, as well as effective prevention and intervention measures. Federal agencies such as DHS S&T and the National Institute of Justice (NIJ) are at the forefront of this work. DHS engages closely with state and local organizations such as law enforcement, non-governmental organizations, anti-violence groups, mental health clinicians, and public health organizations. DHS S&T supports state and local terrorism prevention efforts by delivering scientifically rigorous and publicly available research to:

- 1) Understand individuals' motives both for engaging in and disengaging from violent extremism;
- 2) Develop and support tailored interventions with local partners; and
- 3) Evaluate the effectiveness of intervention and prevention programs.

Looking to the future, S&T is excited to continue this work to inform policies and actions with evidence-based research. This fall, S&T will kick off a series of systematic reviews with the Campbell Collaboration. Systematic reviews synthesize the best available empirical evidence on a topic to arrive at defensible conclusions and generalizations. S&T is coordinating this project in partnership with Australia, Canada, Sweden and the United Kingdom. Additionally, S&T will kick off a series of additional local program evaluations for a handful of [2016 DHS grant recipients](#), which seek community-driven solutions to counter terrorist recruitment and radicalization.

To learn more about DHS S&T's terrorism prevention research portfolio, visit the terrorism prevention pages: <https://www.dhs.gov/science-and-technology/terrorism-prevention>.

## S&T Presents Public Safety Capabilities at APCO Conference

S&T team members made a great showing at the Association of Public-Safety Communications Officials (APCO) Annual Conference and Expo on August 5-8 in Las Vegas. APCO is the premier event for public safety communications officials, attracting nearly 6,000 participants from across law enforcement, fire service and emergency medical services communities and government agencies. S&T Program Managers John Merrill, Cuong Luu and Sridhar Kowdley led informative educational tracks on topics such as [video analytic applications](#) for public safety, cyber and [electronic jamming threats](#), as well as updates about the important work S&T is doing to improve public safety communications. Maximizing on key players being in the same location at the same time, the [Project 25 Compliance Assessment Program \(P25 CAP\)](#) also held several key meetings in conjunction with the conference.

In partnership with the DHS Office of Emergency Communications, S&T exhibited an array of innovative technologies and responder gear. This included a state-of-the-art, human-like reasoning system to collect data and provide tailored situational awareness information to first responders, and an ultra-small, low-cost hazardous gas and particulate detector that targets different gases using chemical sensor technology. Advanced firefighter uniforms were also displayed, including one that provides an extra layer of protection to seal gaps around the gloves and wrists, boots and ankles, etc., to prevent skin from absorbing toxic particulates and vapors. Other featured equipment included a lightweight uniform designed with improved form, fit and function to provide equal or better protection against burns, while reducing heat stress on firefighters during wildland fires.

Events such as APCO provide an important opportunity for S&T to meet with the public safety community face to face to engage on pressing issues and challenges they encounter, and share the technologies and solutions that S&T has been developing to assist them in their missions. Keep up with events S&T will participate in via: <https://www.dhs.gov/science-and-technology/events>.



## S&T Field Tests ADRAS, New Roadside Safety Technology

In late August, S&T field-tested new technology that aims to keep both first responders and motorists safer on our nation's roadways. The [Automated Driver and Responder Alert System](#), or ADRAS, is a two-part system that sends alerts and warnings both to responders tending to incident scenes and to drivers approaching at dangerous speeds—affording precious seconds to slow down and move to a safer spot.

“When I ride at night, that’s probably the most dangerous time to be an EMT. It’s very noisy, and because drivers don’t see you that well, I’ve come very close to getting hit,” said Margaret Fowke, volunteer emergency medical technician with the Silver Spring (Maryland) Fire Department. “When I found out about ADRAS, I thought ‘this is really going to be the answer.’ It has the potential to save a lot of lives.”

ADRAS has two main components: an emergency vehicle-mounted mast with radar, cameras, loud speakers and a siren; as well as an American National Standards Institute-standard safety vest for first responders equipped with light-emitting diode (LED) lights and small oscillatory motors. The system is activated when the radar detects an oncoming vehicle traveling above a preset speed, resulting in an audible alert. When vehicles do not heed the alert to reduce speed, the vest illuminates, flashes and vibrates so the responders can move out of harm’s way.



“The tactile warning, lights flashing, siren and alarm system, the verbal warning—all of that really can contribute to necessary awareness,” said J. David Smith, Chair of the Administration of Justice and Homeland Security Department at Salve Regina University. “Seconds count when you’re out on the side of the highway. If you gain 2, 3, 6 or 7 seconds, as we saw with this technology, if you can provide that measure of safety with advanced warning, that can be the difference between life and death.”

Operational field assessments like this one, led by Program Managers Dr. Angela Ervin and Kimberli Jones-Holt, as well as S&T’s National Urban Security Technology Laboratory, are an essential part of S&T’s research and development process. Deploying technologies in a real-world setting provides valuable practitioner feedback prior to commercialization. At the Federal Law Enforcement Training Center (FLETC) in Maryland, a group of first responders and state and federal transportation stakeholders spent hours on a closed vehicle track evaluating ADRAS in several roadway response scenarios.



“I think being out here today is an overall plus for first responders worldwide,” said Reo Nelson of the U.S. Department of Transportation’s (DOT) National Highway Traffic Safety Administration. “It’s putting a spotlight on safety. Anytime you do that, it’s a plus all around.”

James Austrich of DOT’s Federal Highway Administration agreed: “Too many of our drivers are being struck by errant motorists...distracted, drunk and drowsy drivers...and this research will hopefully eliminate that one day.”



Feedback from the operational field test will soon be posted to the S&T website. The technology should be available to first responder agencies by spring 2019.

## [S&T and the International Forum to Advance First Responder Innovation \(IFAFRI\) Partner to Spur First Responder Technology Innovation](#)

First responders around the globe share a common mission to ensure the safety and security of the people they serve, as they often respond to complex incidents like the Deep Water Horizon oil spill and Fukushima Daiichi nuclear disaster. To respond more effectively, safely and efficiently to both small and large-scale emergencies, the world's first responders need technologically advanced tools and equipment that are also affordable. On August 9, 2018, DHS S&T kicked off the first of its kind IFAFRI Industry Stakeholder summit to advance the development of affordable, innovative technology for the over 7.5 million first responders across IFAFRI member nations. DHS S&T and the IFAFRI shared the following objectives for holding this summit:

1. Provide a clear understanding of the common global high priority capability gaps.
2. Provide a clear understanding of the first responder market.
3. Hear from industry and other developers about any potential solutions to the IFAFRI capability gaps.

The summit included representatives from industry, academia, government, media and the first responder community, who gathered to discuss solutions for the common technology capability gaps of first responders. Also in attendance were members of S&T's First Responder Resource Group, who shared perspectives and real-world, operational experience as to why this global collaboration is so critical.



The following IFAFRI capability gaps were discussed during the summit:

1. The ability to know the location of responders and their proximity to risks and hazards in real time.
2. The ability to detect, monitor, and analyze passive and active threats and hazard at incident scenes in real time.
3. The ability to rapidly identify hazardous agents and contaminants.
4. The ability to incorporate information from multiple and non-traditional sources (e.g., crowd-sourcing and social media) into incident command operations.

In opening remarks, André Hentz, S&T Acting Deputy Under Secretary, said, "What we really want to do is develop a more robust and methodical R&D duty cycle that helps us be better stewards of the taxpayer dollars that we get to affect and drive down risks to first responders."

He added, "What we are trying to do is motivate industry to think about our problems and bring offerings to the table that help us save lives."

Other speakers at the summit emphasized the importance of IFAFRI in bringing together a wide spectrum of stakeholders from different sectors to provide solutions to the needs of first responders.

Building on the summit, IFAFRI will continue to provide a platform for knowledge-sharing and network-building among all relevant stakeholders. Over the next couple of months, IFAFRI will use the information gathered from stakeholders at the summit to strengthen outreach plans, identify technologies that can assist first responders, work with developers on new technology, and plan for opportunities to host similar gatherings.

For more information about IFAFRI and its opportunities for industry, visit [www.internationalresponderforum.org](http://www.internationalresponderforum.org)



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