

# trajectory

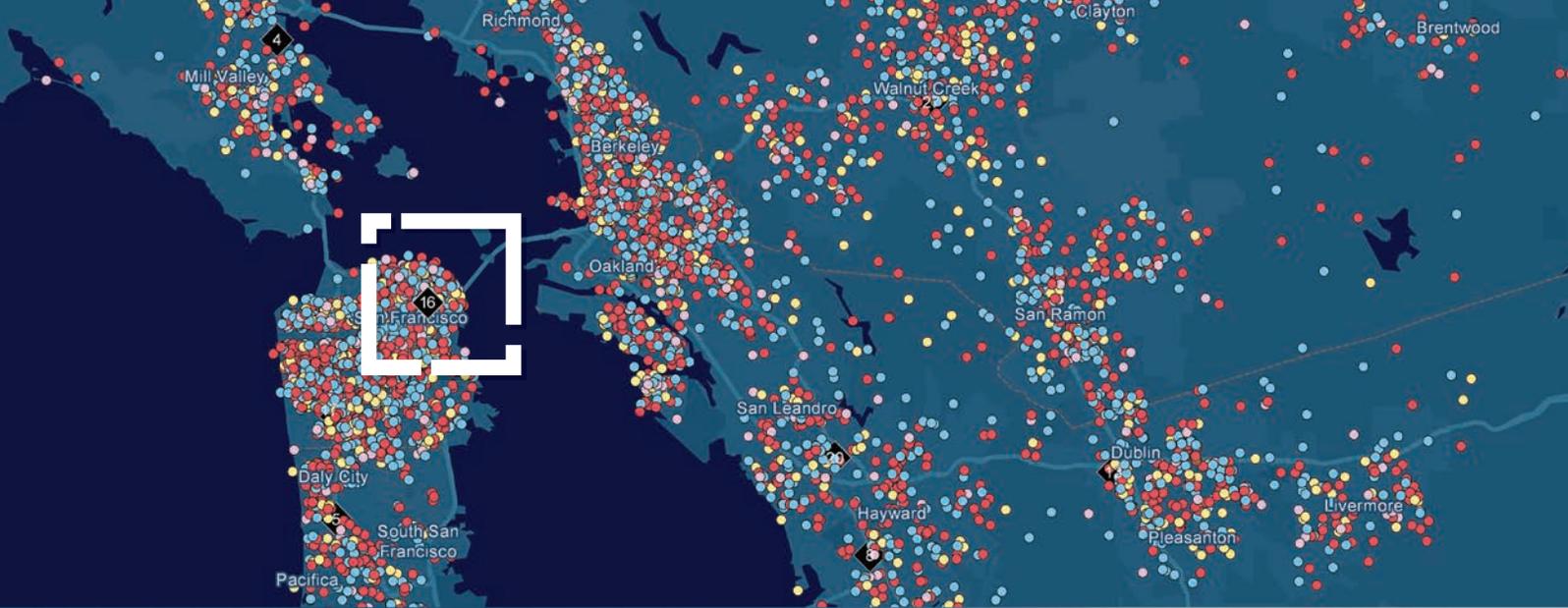
THE OFFICIAL MAGAZINE OF THE UNITED STATES GEOSPATIAL INTELLIGENCE FOUNDATION

- **Police:** Geospatial Intelligence for Policing
- **Fire:** Situational Analysis
- **EMS:** Enabling Rapid Response



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2017  
PUBLIC SAFETY  
SPECIAL EDITION

The Fairfax County Police helicopter, Fairfax 1, and motor units.

PHOTO COURTESY OF NORTHERN VIRGINIA REGIONAL INTELLIGENCE CENTER



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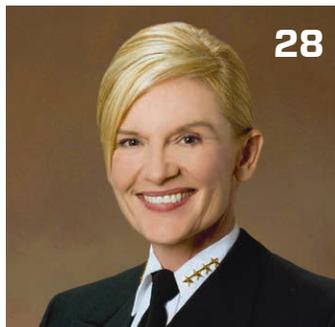
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Visit us online to read a bonus feature about the GeoQ app for first responders.

**ON THE COVER:** Members of FEMA's Urban Search and Rescue Nebraska Task Force One perform one of many water rescues in the aftermath of Hurricane Harvey. Photo courtesy of FEMA.

# Revolutionizing Mission Effectiveness

On behalf of the entire *trajectory* team, I'm thrilled to share our first special edition. It's our hope that this is an important step in further integrating the precepts of geospatial intelligence (GEOINT) into the practice and lexicon of public safety professionals. As I like to say, while GEOINT was created in the "laboratory" of the defense and intelligence communities in the wake of 9/11, it has in the intervening years escaped the confines of that lab and gone viral.

The national security sector loosely defines GEOINT as the combination of: remote sensing from phones, drones, and space; geospatial/location information of all layers and types; and data management, analytics, and visualization for an actionable purpose. However, in the public safety community, GEOINT may be called something else entirely and be leveraged through the combination of visualization tools such as crime mapping, network analysis, CompStat, route analysis, crisis mapping, critical infrastructure assessment, and more.

USGIF identified the virulent nature of GEOINT in *trajectory's* 2015 cover story, "The GEOINT Revolution," and further explored it when we subsequently themed our 2016 annual Symposium with the same moniker. The thesis of the GEOINT Revolution article is there are multiple technologies undergoing rapid change, and when viewed collectively, create a powerful synergy for revolutionary advances in the GEOINT field.

In the years since 9/11, the defense, intelligence, and, more recently, the homeland security communities have leveraged the power of GEOINT to enhance their respective and collective mission effectiveness. Over time, doctrine has been generated and training, education, and professional development opportunities have developed.

As GEOINT is increasingly adopted in other sectors, I see a tremendous opportunity to share this body of knowledge and to leverage lessons learned. Our first responders ought not make the same mistakes or blindly face some of the same challenges the traditional GEOINT Community has already overcome. And it is my hope as you find new ways to deploy these approaches that we in turn can learn from your community.

We at USGIF have endeavored to engage with law enforcement, fire and rescue services, emergency medical services, and others to foster an ongoing dialogue regarding public safety mission applications for GEOINT. Our respective communities share meaningful core values exemplified by selfless service to others, fierce dedication to mission, and genuine camaraderie.

We've all seen recent exemplars of the close cooperation among first responders and national security organizations during wildfires in the American west and southwest, and in the wake of hurricanes Harvey, Irma, and Maria. At every level, rescue and relief organizations rely upon GEOINT to accomplish their missions.

It's my fervent hope that this edition of *trajectory* ends up in the hands of police officers, fire services professionals, EMS workers, emergency planners, and others who will recognize the opportunity at hand. As a result, I hope you will participate in the discussion that will fully unleash the power of the GEOINT Revolution in support of your vital role in serving, protecting, and responding to keep our nation safe.

USGIF is eager to extend its educational mandate to this important constituency and use our unique power as a convening authority to create and sustain knowledge transfer to further develop the GEOINT tradecraft in support of public safety missions.



**KEITH J. MASBACK** | CEO, USGIF  
@geointer



USGIF CEO Keith Masback with members of the Orange County Sheriff's department at USGIF's GEOINT 2016 Symposium in Orlando, Fla.

**trajectory**

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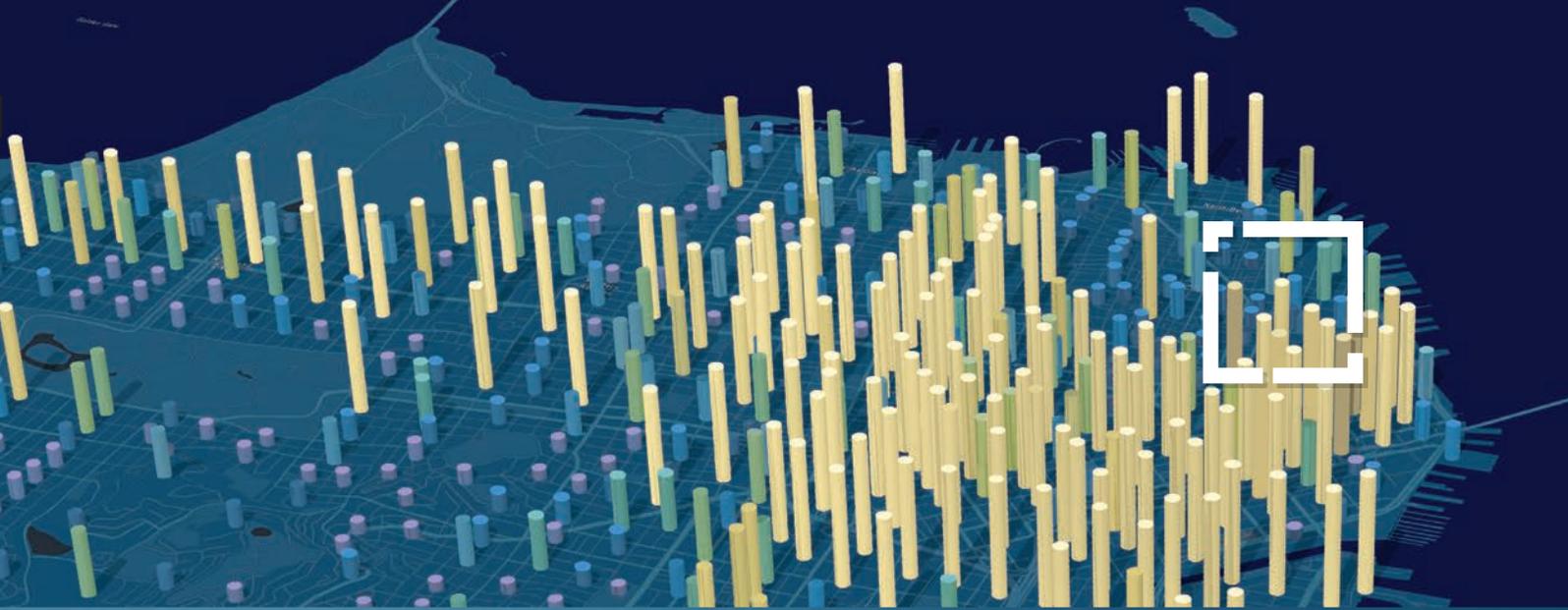
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# INTsider

COMMUNITY NEWS,  
EVENTS, AND EDUCATION

 PUBLIC SAFETY WORKSHOP

■ USGIF NEWS  
■ GEOINT COMMUNITY NEWS  
■ EDUCATION  
■ APPLICATIONS  
■ CIVIL



## Strengthening Community Resilience



USGIF's Dr. Darryl Murdock leads first responders and public safety GIS experts in a discussion at the University of Alabama in August.

In August, the United States Geospatial Intelligence Foundation (USGIF), gathered first responders and local and state GIS leaders to gain a common understanding of the current state of geospatial maturity in the public safety field.

Held at the National Geospatial Preparedness Summit at the University of Alabama in partnership with the National Alliance for Public Safety GIS (NAPSG) Foundation, the workshop was titled "Strengthening Community Resilience Through Location-Enabled Data, Technology, and Analysis." Facilitators Talbot Brooks of Delta State University and USGIF Vice President of Professional Development Dr. Darryl Murdock led participants in a discussion of challenges in advancing implementation as well as in identifying needs, requirements, and potential solutions.

USGIF is using the workshop outcomes to help inform a white paper it is developing for the Department of Homeland Security examining the intersection of geospatial intelligence and community resilience.



## MODERN SLAVERY

### Cracking Down on Human Trafficking with Free Software

Approximately 325,000 U.S. children are at risk for sex trafficking and 75 percent of these victims are advertised online, according to Thorn, an organization dedicated to driving technology innovation to fight the sexual exploitation of children.

Yet many law enforcement agencies lack the funding to dedicate officers to human trafficking cases, let alone to purchase trafficking-specific software. Those working in the field described the pursuit of intense cases with a lack of resources.

“If you start calling random police departments saying, ‘Who works human trafficking?’ you’re probably going to get 50 percent of agencies that say ‘Nobody,’” said 2nd Lt. James Bacon, who oversees the Child Exploitation Squad for the Fairfax County Police Department in Virginia.

This is why Thorn created Spotlight—a platform leveraging big data analytics and visualization, machine learning, and natural language processing—to automate the monitoring of ads on websites such as  **backpage.com**. Thorn, in collaboration with technical partner Digital Reasoning, provides Spotlight for free to federal, state, and local law enforcement agencies around the country.

Thorn and Digital Reasoning joined forces in 2014, after Thorn learned in its interviews with survivors that many trafficked children were forced to write their own online ads. Using both supervised and unsupervised learning, Digital Reasoning trained Spotlight to determine which ads children most likely wrote and then elevate the most high-risk ads to help law enforcement focus their investigations.

According to Bacon, software such as Spotlight helps police conduct link analysis to detect networks and track movement from one location or jurisdiction to another.

Spotlight is now in the hands of more than 5,000 law enforcement officers at 1,290 agencies across all 50 states and Canada.

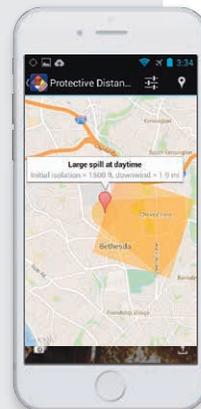
As of Sept. 7, Spotlight aided in **8,305** trafficking investigations, assisted in identifying **2,025** child sex trafficking victims and more than **4,624** adult victims, and helped bring more than **2,249** traffickers to justice.

## ON-THE-JOB APPS

### Wiser

Published by the U.S. National Library of Medicine, Wiser is designed to assist first responders following hazardous material incidents such as tanker truck accidents or meltdowns at chemical facilities. The app provides EMTs and HazMat teams immediate access to critical information such as substance identification, reactivity characteristics, patient care guidelines, and approved material handling procedures. This information is coupled with useful tools such as protective distance map overlays and containment and cleanup advice to help mitigate damage and keep the public safe.

[wiser.nlm.nih.gov](http://wiser.nlm.nih.gov)



### Firestop

A cloud-based response software, Firestop assists firefighters in the field and cuts down on tedious workflows, allowing

data to be shared and analyzed in real time. Firestop displays relevant information collected in the pre-planning process, identifying hydrants, alarm panels, building layouts, and more before an incident occurs. GIS data is easily imported into the app, and responders can use satellite imagery and Google Street View to prepare for emergency situations. Additionally, data such as locations, waypoints, and even photos can be shared with fellow responders.

[firestopapp.com](http://firestopapp.com)

### Resuscitation

Aspiring medical professionals can use Resuscitation to walk through simulated procedures and diagnosis scenarios. Users treat an ill patient in one of many clinical cases, such as a 79-year-old with shortness of breath or an 18-year-old found unconscious next to an empty pill bottle. Correct decisions accumulate points in the app, while mistakes remove them. At the end of the case, the user receives a score and some procedural feedback.

[emgladiators.com/resus](http://emgladiators.com/resus)



IMAGE COURTESY OF DHS S&T



An EDGE firefighter avatar battles a blaze in the hotel restaurant.

**PREPAREDNESS**

**EDGE: A Free Training Platform for Responders**

For first responders, preparedness is key to a seamless, swift, and effective response, particularly during critical incidents when time is of the essence. To enable better preparedness, the Department of Homeland Security (DHS) Science and Technology (S&T) Directorate created a free, state-of-the-art virtual training platform public safety professionals of all disciplines can use to simulate a coordinated response with tactics and techniques specific to their own departments.

The Enhanced Dynamic Geo-Social Environment (EDGE) can be used by a single agency or across agencies, jurisdictions, and disciplines. Developed in partnership with the U.S. Army Research Laboratory and Cole Engineering Services, EDGE allows responders to

collaboratively role-play a number of complex scenarios in a virtual environment, improving coordination

and communication before a catastrophic event happens in order to mitigate injuries and loss of life during a live response. The training is not pre-scripted—actual responders using agency-specific standard operating procedures control most EDGE avatars.

The first EDGE environment, available now, brings together law enforcement, fire, emergency medical, dispatch, and unified command in response to active shooters and fires at a local hotel. The second scenario, available this fall, takes place at a school and builds in training for teachers, administrators, and security personnel. The open sandbox nature of EDGE allows instructors to develop custom curricula for a wide range of additional incidents such as medical emergencies, hostage situations, multi-alarm fires, and armed robberies.

**FOR MORE INFORMATION** on how to obtain EDGE at no cost, contact [first.responder@hq.dhs.gov](mailto:first.responder@hq.dhs.gov).

**CRIME PREDICTION**

**George Mason University Awarded \$10M DHS Grant**

The Department of Homeland Security (DHS) selected George Mason University (GMU) to lead the department’s Center of Excellence in Criminal Investigations and Network Analysis. The \$10 million grant is among the latest research awards the university has received. Under the grant, GMU will lead a consortium of universities and law enforcement agencies to investigate patterns of criminal activities and forensics as well as to develop strategies to predict and disrupt transnational crime.

**BOOKSHELF**

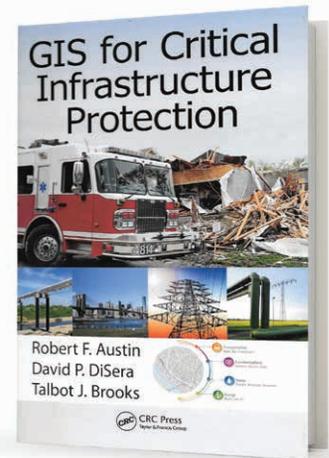
**GIS & Critical Infrastructure Protection**

Geographic Information Systems play a primary role in critical infrastructure protection (CIP). As defined by the Department of Homeland Security: “Critical infrastructure are the assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, public health or safety, or any combination thereof.”

The use of GIS to support the protection of critical infrastructure is widespread, and captured in the book *GIS for Critical Infrastructure Protection* by Robert F. Austin, David P. DiSera, and Talbot J. Brooks. Examples include the use of GIS-based situational awareness platforms for national security special events such as the Democratic and Republican National Conventions in 2012. Other examples are the nationwide use of “Call Before You Dig” systems linked to geographic databases, the application of geo-coded databases to the provision of first responder routing services, and the assessment of flood and other natural hazard risks using terrain models and satellite imagery.

This book introduces the basic components of GIS that serve as the platform for specialized analysis, risk assessment, and remediation. The model of infrastructure interdependency is examined and applied to the problem of infrastructure protection. In addition, a series of specific case studies are presented to clarify several important issues in CIP, including the importance of data quality, data sharing, and the use of cloud services. The importance of the U.S. National Grid as a tool for remediation is also considered.

This text provides first responders and agencies responsible for CIP with an understanding of the benefits of GIS and a basic knowledge of the range of geographic information tools available to support their efforts.



The use of GIS to support the protection of critical infrastructure is widespread.



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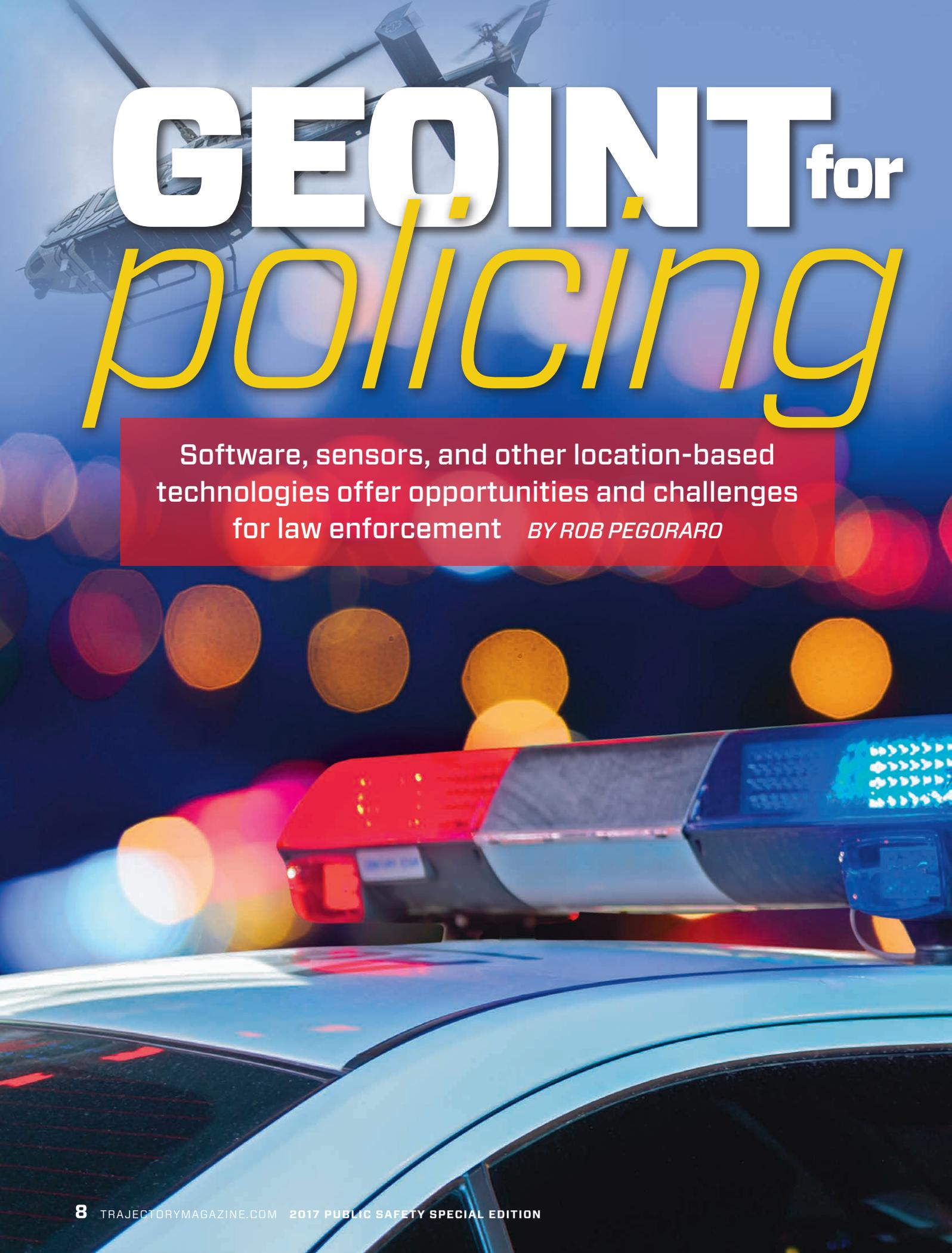


### Grow your Network

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# GEOINT<sup>for</sup> *policing*

Software, sensors, and other location-based technologies offer opportunities and challenges for law enforcement *BY ROB PEGORARO*



**THE TRADITIONAL WHO-WHAT-WHEN-WHERE** crime report is starting to acquire many more details—from the proximity of the nearest ATM or street light to the occupational, educational, or religious significance of the date.

These are the kind of data points and insights any cop on the scene would notice, but which could then easily get lost in the system.

By combining increasingly detailed databases with powerful software that can detect patterns almost as fast as reports are filed, police departments and other first responders can deploy their resources more efficiently, be more accountable to citizens, and perhaps even develop a sense of where crime is likely to occur next.

But there's also a risk of confusion and unnecessary expense as busy police departments try to assess pitches from geospatial intelligence (GEOINT) firms.

"We're almost getting flooded by them," said Police Lt. Joseph Flynn, assistant commander of the Fairfax County Police Department's Criminal Intelligence Division and deputy director of the Northern Virginia Regional Intelligence Center. "It's still so new, and what do we want?"

In the first two Chicago districts to use HunchLab, shootings have so far dropped by 33 percent, well above the 14 percent drop citywide.

### PRESCIENT ANALYTICS

Applying GEOINT to policing begins with the basics of incident reports and 911 calls, explained Robert Cheetham, CEO of the Philadelphia firm Azavea. Its subsidiary HunchLab performs some of the leading work in next-generation policing software.

HunchLab models incorporate “a whole range of other things,” Cheetham said. He listed both nearby amenities and businesses—transit stops, ATMs, liquor stores, and even lighting—in addition to temporal factors such as the time of the day, the day of the week, whether school was in session, and whether it was a holiday.

In each municipality, HunchLab builds a model that incorporates these inputs and calculates the potential harm of types of crime using the RAND Corporation’s “Cost of Crime” calculations. The results—at an annual subscription cost of \$20,000

to \$80,000 depending on municipality size, with custom pricing for the largest cities—not only illuminate crime trends but offer a hint of where they’re likely to head.

“What we’re doing is not prediction,” Cheetham said. “It’s more of a forecast of a difference in risk.”

The Chicago Police Department (CPD) ranks as HunchLab’s highest-profile client on account of the high rate of shootings across the city. CPD began deploying HunchLab’s system in January 2017; by mid-year, the department had brought it to the six of its 25 districts that account for 25 percent of the city’s shootings.

“We’ve seen what I’ll say are promising results,” said Jonathan Lewin, chief of CPD’s Bureau of Technical Services. In the first two districts to get this upgrade, shootings have so far dropped by 33 percent, well above the 14 percent drop citywide.

Lewin added the department is using the data it collects not just to dispatch officers faster but to speed actions by other parts of city government.

“One of the things we looked at was 311 calls for streetlights out,” he said. “Does that tend to correlate with nighttime shootings?”

As a result, Lewin said, the city is now prioritizing its deployment of connected LED streetlights “in some of the areas where we think it might have the greatest impact on reducing crime.”

However, if law enforcement agencies don’t clean up their data before implementing forecasting technologies, they risk being led astray.

“Not having the proper protocols and data governance policies to prevent incomplete and inaccurate data entry leads to the issue of ‘junk in, junk out,’” Jody Weis, public safety lead at Accenture, warned via e-mail. “The finest analytic system, with the absolute best algorithms, will be useless if the data it is analyzing isn’t accurate.”

Jeff Gallagher, a GIS specialist with the Fairfax County Police Department, advised cultivating relationships with local government information technology and GIS professionals.

“Get out of the little pigeonhole and see the amount of data your county has,” Gallagher said.

### UNBLINKING EYES

In addition to information derived from officers, citizens, and databases, many police departments also have unblinking eyes on their communities in the form of automated sensors that collect real-time data for quick analysis.

“If it’s collecting a location, we can bring it in,” said John Beck, Esri’s industry manager for police. Esri’s GIS software can incorporate data from license-plate reading sensors, ShotSpotter gunfire-detecting microphones, officers’ body-worn cameras, and GPS anklets worn by offenders.

Such data integration can add to a department’s budget and can encounter resistance from citizens. For instance, Lewin said CPD cameras got a better reception in communities after the department switched to a less obvious model that didn’t have continuously flashing blue lights.

But they do work.

“People are now actually catching criminals in the act based on the predictive analysis of all this historic and real-time data,” Beck said.

*HunchLab, a subsidiary of Philadelphia-based Azavea, offers next-generation policing software that illuminates crime trends.*

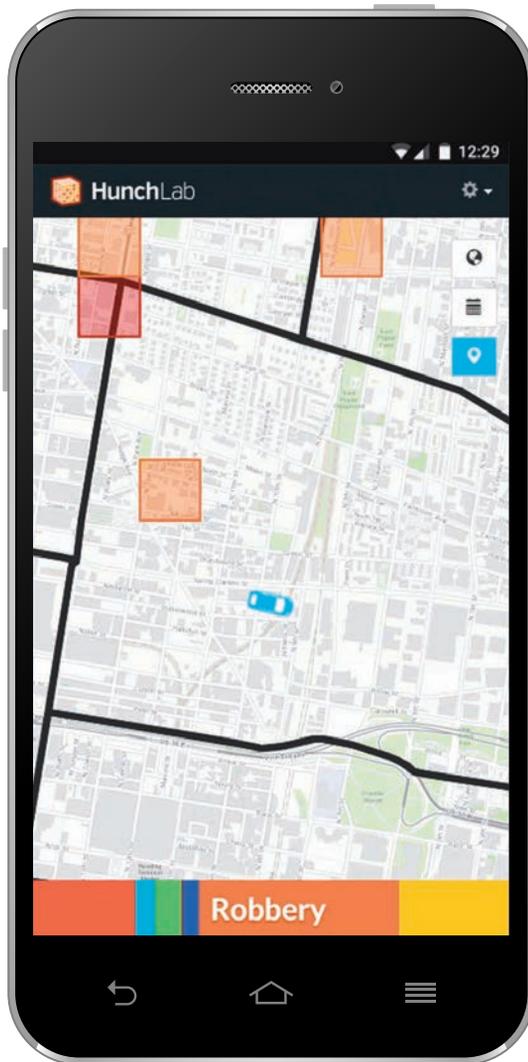


IMAGE COURTESY OF AZAVEA

However, Beck continued, with the deluge of new information also comes the risk of overload-ing officers with data that should first pass an analyst’s eyes.

“We’re seeing a lot more real-time crime centers in the U.S. and beyond,” Beck said, complimenting CPD for setting up these centers in individual districts. That, however, should not come at the cost of taking officers off the street.

Lewin said CPD hired eight civilian analysts to embed in these centers. It also had representatives from HunchLab and security systems firm Genetec go on ride-alongs with officers to learn how to refine their user interfaces.

An existing set of analog sensors—as in, the eyes and ears of citizens—remains essential.

“Don’t become so over-reliant on [technology] that you become disconnected from the community,” said Sean Whitcomb, a sergeant and spokesman with the Seattle Police Department (SPD). He pointed to SPD’s regular incorporation of citizen input into its SeaStat crime-statistics program. “The value is increased exponentially because we supplement our own data with real-time feedback from the community.”

## A BALANCING ACT

Collecting new data and building predictive models can also help police agencies increase their accountability to citizens.

“When I was a cop, we didn’t share any information with the public,” Beck said. “Now, police are sharing information about all of their activity, including use of force and police-involved shootings, and making that data open to the public.”

He pointed to the Philadelphia Police Department, whose website documents officer-involved shootings and allows visitors to compare the locations of those incidents with the locations of gun crimes across the city.

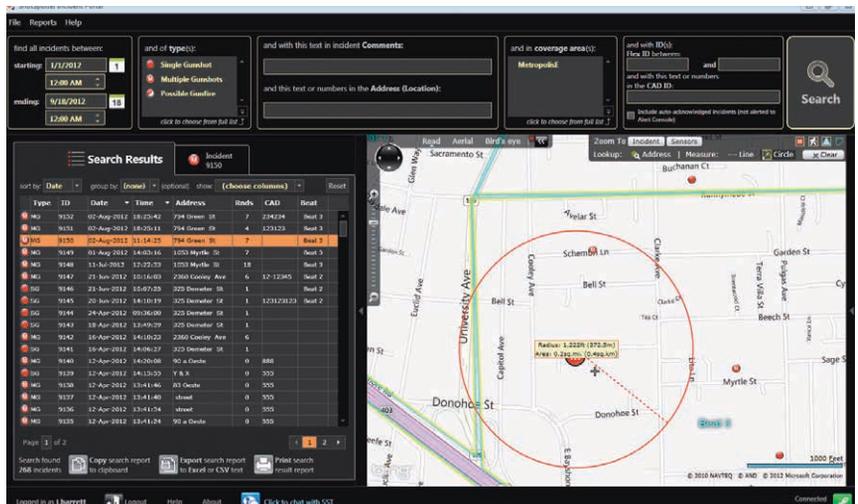
Public desire for accountability is another factor driving law enforcement agencies to deploy GEOINT.

In Chicago, the city’s Independent Police Review Authority now maintains a searchable use-of-force database, including audio and video from officers’ body cameras. And in Seattle, a 2011 Department of Justice investigation that found fault with SPD’s collection of data led the department to partner with Accenture to build a data analytics platform.

But data collection in policing can also generate public dissatisfaction with police departments. In 2016, citizens were angered to learn SPD had purchased Geofeedia’s social media analysis software two years earlier.

Weis and Beck each pointed to social media monitoring as the next frontier in the use of GEOINT by police. But after SPD’s attempts to glean intelligence from status updates went awry, the resulting blowback led Facebook and Twitter to yank Geofeedia’s access to their networks.

“There’s a very fine line between government surveillance and spying,” SPD’s Whitcomb said, adding the department now focuses on the social postings of individual suspects. “Something causes more harm than good if it erodes public trust and confidence.”



Said CPD’s Lewin, “Community partnership requires that we engage our stakeholders, and part of that is being as transparent as possible.”

Jay Stanley, senior policy analyst for the American Civil Liberties Union, emphasized police departments and the GEOINT industry should maintain transparency to help “reduce bias and improve trust with communities.”

Cheetham echoed Stanley’s point. “I want to be on the right side of history on this,” he said.

## MORE RESEARCH NEEDED

Cheetham and Stanley separately noted the need for more published research on the effectiveness of GEOINT and predictive policing.

For example, while the Police Executive Research Forum has spent years investigating law enforcement best practices, it has yet to study this technology, Assistant Communications Director James McGinty wrote via e-mail.

A former police officer and current academic concurred via email. “The independent empirical research is limited and equivocal,” wrote Dr. Kim Rossmo, director of the Center for Geospatial Intelligence and Investigation at Texas State University.

Lewin said CPD is now working with the University of Chicago’s Crime Lab to research how its initial deployment of predictive policing technology has fared.

But, he added, the real-world consequences of police work make it difficult to run a classic experiment in which a control group is left out of a technological advance: “If you have something that could be effective, you want to use it.”

*Data from sensors such as the ShotSpotter gunshot detection and location service can be integrated with other data into GIS systems for analysis by police departments.*

# situati *analysis*

Satellite imagery, drones, advanced analysis, and other emerging technologies are quickly changing the face of firefighting

BY JAY S. DAUGHTRY

*Fire glows on a hillside in Napa, Calif., on October 9, as multiple wind-driven fires whipped through the region.*

# onal



## **THE USE OF GEOSPATIAL INTELLIGENCE (GEOINT)**

tools such as remote sensing and data visualization is on the rise in the firefighting community, and the future of the profession will be greatly influenced by ongoing technological advances.

Kate Dargan, former California State Fire Marshal and co-founder of Intterra, reflected on her early career as an air attack officer fighting wildfires in her home state.

“I was the ‘eye in the sky’ translating what I was looking at from several thousand feet to the firefighters on the ground,” she said, recalling later trying to capture video from the air using a handheld camera.

Today, commercial satellite imagery as well as LiDAR, hyperspectral, and infrared imagery collected from manned and unmanned planes could all be part of a firefighter's toolkit. When paired with powerful data analysis platforms and mobile apps, GEOINT offers first responders greater situational awareness and a better understanding of the communities they serve.

**“If additional staffing, stations, or [equipment] are needed, a fire chief has the [geospatial] evidence needed to justify a budget request.”**

—TALBOT BROOKS, DELTA STATE UNIVERSITY

### A RAPID EVOLUTION

“Many firefighters may only see the world through the windshield of the fire truck,” Dargan said, but noted available technologies and firefighter expectations are rapidly evolving.

For example, she said, fire chiefs may understand the basics of infrared technology but not yet be conversant in the various types of infrared and their corresponding capabilities. Regardless, Dargan said she is seeing the increased presence of unmanned aerial systems (UAS) at industry trade shows and is aware of more and more departments purchasing small drones.

For the last 100 years, firefighters used paper and pencil to create diagrams of buildings and map areas of wildfire risk. Modern fire departments employ geospatial technology

to develop a standard of cover, more efficiently deploy resources, perform risk assessment, and pinpoint potential problem areas, according to Talbot Brooks, firefighter and director of the Center for Interdisciplinary Geospatial Information at Delta State University in Mississippi. Investment in geospatial tools supports risk reduction by being able to plan in advance of an emergency what equipment to use and where to position it. But the ability to improve response and mitigate risks relies on the ability to properly integrate and manipulate geospatial data.

Dargan said the future of firefighting technology includes the networking of disparate imagery derived from

different sensors and organizations. That is what her team strives for with its subscription-based Situation Analyst platform, which pulls all of that imagery together in one place and serves it up to each person in an organization modified for his or her needs.

David Holmerud, a fire service management consultant and former deputy fire chief in Solana Beach, Calif., emphasized the importance of asking the correct questions of the data at the right times: “Is there something more we can do to change the outcome of the responses? Of these structural fires, how many were contained to the original building? What difference did what we do make?”

Knowing how to draw the right conclusions from the data is the key to advancing the capabilities of the modern-day firefighter.

Startup Descartes Labs, founded by a group of scientists from Los Alamos National Laboratory, is pairing satellite imagery with machine learning to help draw better conclusions for firefighting. In a company blog post titled “Fighting Wildfires Using a Cloud-based Supercomputer,” research scientist Daniela Moody writes: “The Descartes Labs Platform provides us with a view of the planet that no one has ever seen before—not only is it multi-sensor, multi-resolution, and multispectral—it’s also a multi-decadal historical lens.”

This information helps to ascertain damage from fires over time and can be used to make better decisions about how to fight fires in the future. The platform enables users to extract information not available to the naked eye, pull in a lot more data than can be done manually, and leverage machine learning processes that incorporate algorithms based on numerous data points.

“During the course of a fire, especially one with limited allocated resources, satellite imagery analysis could better direct ground crews to hotspot and containment areas,” Moody wrote.

### BUILDING PARTNERSHIPS

Communication among the public safety community is also important when adopting new technologies. Holmerud recommends initiating and maintaining an open dialogue with city planners who may have already gathered and even visualized valuable data fire services could potentially tap into.

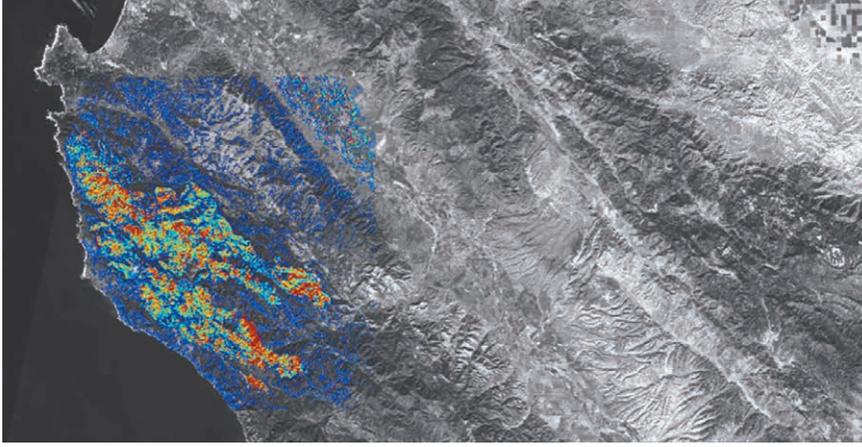
“For example, when a new subdivision is planned, many different data elements are available as a result of the approval process,” Holmerud said. “These data sets, ranging from street layouts to location of underground utilities, can be used to provide the basis of fire department pre-plans and updates to response maps and dispatching procedures. It can be a time saver as well as provide accurate data.”

Dargan encourages fire chiefs to participate in wide-ranging discussions that include police departments, community health workers, public works, transportation officials, and other civic departments. These conversations will introduce fire service leaders to technologies not designed specifically for firefighting, but that could be adapted for their missions.

*The Bolivar County Volunteer Fire Department concludes a live fire training at a donated structure in Benoit, Miss., in February 2009.*



PHOTO COURTESY OF DELTA STATE UNIVERSITY



This map by Descartes Labs shows the burn severity index for the 2016 Soberanes fire on California's Monterey peninsula.

Holmerud, who is also an instructor at the National Fire Academy in Emmitsburg, Md., touts the value of collaborating with local colleges and universities on projects that could be of benefit to both parties. For example, the city of Wilson, N.C., has done significant work in mapping layers of data such as water flow, utility shut offs, and the number of people potentially living in a given structure. The city of Wilson makes these maps available to Holmerud's students, who manipulate the layers behind the scenes by changing various conditions and factors. This activity enables students to go back to their communities with a better understanding of where information comes from and who they need to work with to ensure adequate resiliency and response planning.

Public-private partnerships could also pave the way toward better technological support for fire services. In the Phoenix, Ariz., area, 27 fire departments broke through jurisdictional boundaries to integrate their response to 911 calls. With a GPS unit now in every fire truck, the team in the best position to respond is dispatched to an incident, regardless of geographic boundaries. This new approach has resulted in shorter response times throughout the area.

Eric Prosser, information technology officer for the Santa Clara County Fire Department in California, points to the multi-agency coordination that was necessary for Santa Clara to host Super Bowl 50 in 2016. According to the NFL, 1.1 million people attended the game and related events.

Prosser's iMAP Team won a USGIF Award in 2016 for providing the Santa Clara County Multi-Agency Coordination Center with a GEOINT-based decision and situational awareness platform. The iMAP team developed an enterprise GEOINT system used to manage all fire and medical service operations throughout Super Bowl 50. In collaboration with Dargan's Intterra, the developers generated the ability to integrate 911 computer-aided dispatch information, map special events throughout the region, monitor resource availability, view GIS layers to include near real-time satellite imagery, and analyze data trends.

"The results of iMap enabled us to be better prepared for future special events and large-scale incidents, and to have situational awareness at both the department and operational area levels," Prosser said. "This additional data provides us with useful information on a daily basis within the Silicon Valley."

### THE GEOSPATIAL ROI

Holmerud said although many fire departments are slow to officially adopt GEOINT, he is beginning to see volunteer departments systematically use smartphone apps to gain a

sense of who's responding as well as their locations and estimated arrival times. He believes these kinds of tools will make departments hungry for more geospatial information.

"We're starting to see the value of [geospatial] intelligence coupled with response software—starting to see what they can do and look at the possibilities," Holmerud said.

The realization that geospatial technology can be a force multiplier when it comes to getting the most out of existing resources will also help drive adoption, according to Brooks.

"If I want budget to go after something, now I can show it," Brooks said of his ability to use data to test and prove a theory. "It's not just a supposition. [Geospatial tools are] a good way of separating fact from fiction."

Developing a standard of cover using GEOINT provides a data-driven solution for understanding where departmental strengths and weaknesses are located geographically.

"If additional staffing, stations, or [equipment] are needed, a fire chief has the [geospatial] evidence needed to justify a budget request," Brooks said. "Supposition and anecdote are removed from the process and political leadership can have more confidence in decisions that often cost (or save) millions of dollars."

According to Dargan, there are three main areas in which fire departments can invest: equipment, people, and information.

"One of the key messages we're trying to communicate is that information is a resource and a hard commodity that should be planned for and used just like equipment and [people]," she said. "The return on investment for data is or will pan out to be higher than it is for the other two types of resources."

For example, the amount of data a fire department can acquire and put to use through remote sensing is not available through any other method except boots on the ground evaluating each building and area of risk.

"We'll never have enough staff to send feet up every driveway in California to talk to every home or business owner," Dargan said.

Those data-enabled decisions could lead to less costly emergency response with less loss of life and property, she added.

Imagine a firefighter being able to do a voice search while combating a wildland or structural fire, Dargan said. They could say, for example: "Show me houses with wooden roofs and give me their addresses."

This type of timely access to geospatial data will enable firefighters to more effectively respond to emergencies and will significantly improve their ability to predict events and therefore protect more property and save more lives. 🌐

The amount of data a fire department can acquire and put to use through remote sensing is not available through any other method except boots on the ground evaluating each building and area of risk.

The MARVLIS system models the probability of future emergency call locations based on historic data, near-real-time inputs such as dispatch and response times, and factors such as traffic conditions.

*enabling rapid*

**resp**

IMAGE COURTESY OF ESRI



Geospatial intelligence proves a powerful tool for paramedics

BY CARYN SOBEL

# onse



**IN THE EMERGENCY OPERATIONS CENTER**, a dispatcher takes a bystander’s cellphone call about a car crash on a poorly marked rural road. The report prompts the dispatcher to send regional air medics as well as the nearest local ground EMS crew. Next door, EMS managers analyze response statistics for a rapidly growing residential area.

## Jersey City Medical Center EMS doubled its return of spontaneous circulation rate in cardiac arrest victims after integrating MARVLIS into its operations in 2012.

Across town, an EMS crew teaches citizen CPR in a neighborhood with a high cardiac arrest rate. After training, a smartphone app will be integrated with EMS dispatch, so bystander CPR can be started in public spaces before EMS arrives. All of these activities, some long established and others cutting-edge, rely on geospatial intelligence (GEOINT) data and technology to save lives, yield better patient outcomes, and improve agency efficiency.

Early EMS operations used “static deployment,” with a set number of vehicles assigned to permanent stations. In the 1980s, increased call volumes without equal investment in EMS systems led to system status management, which was intended to optimize coverage based on temporal patterns of use.

The advent of computer-aided dispatch and automatic vehicle locator technology allowed dispatchers to determine the closest available ambulance for a call, but it took near real-time analysis and predictive analytics to make the deployment and use of resources truly effective. As economic stresses mandate that services accomplish more with fewer resources, dynamic deployment has become a mainstay in providing efficient and cost-effective coverage.

### DYNAMIC DEPLOYMENT

“In dynamic deployment, ambulances are directed toward the highest uncovered demand at that moment in time. Some call it ‘chasing the blob,’” said Dale Loberger, an active EMS member and a developer at Bradshaw Consulting Services, which developed the Mobile Area Routing & Vehicle Location Information System (MARVLIS). “Demand is constantly being re-evaluated in near real-time and resources are being matched to that demand as their level of availability changes.”

The MARVLIS system models the probability of future call locations based on historic data, near-real-time inputs such as dispatch and response times, and factors such as traffic conditions. The automated forecast is modeled through Esri’s ArcGIS platform and displayed as a mapping interface. Combined, MARVLIS GPS data, GIS modeling, and wireless communications allow EMS to “have the right units at the right places at the right times,” Loberger said.

The lower response times and decreased distances enabled by systems such as MARVLIS and Optima Predict from Intermedix help save lives in the subset of patients that must be reached in four minutes or less to survive. Jersey City Medical Center EMS doubled its return of spontaneous circulation rate in cardiac arrest victims after integrating MARVLIS into its operations in 2012.

A University of Pittsburgh team modeled fatal vehicle crash rates in Pennsylvania from 2013-2014 and distances from trauma resources using Fatality Analysis Reporting System data. They discovered a theoretical 12.3 percent decrease in mortality if two medevac units were to be re-assigned to the higher-incidence areas.

“There was a big disparity for these patients, depending on where they live,” said Joshua Brown, a general surgical resident at the university medical center and lead investigator on the study. “It’s only recently that trauma systems analysts have begun to incorporate GIS tools into their work

## PROVIDING COMMUNITY ROI WITH GEOSPATIAL TOOLS

The month of June brings the Wichita Riverfest to Sedgwick County, Kan. For more than a week, concerts, art shows, athletic events, and more draw crowds of up to several hundred thousand to enjoy themselves and support the community along the Arkansas River.

Handling the logistical demands of providing emergency services to large crowds, concentrated within a several-block radius, is the responsibility of Scott Hadley, director of Sedgwick County EMS. His agency handles all services for the 1,008 square mile area.

“Riverfest requires extra coordination, along with the approximately 170 calls per day that are our normal operations,” Hadley explained, adding that the tools his agency invests in allow daily operations and special events to run more smoothly.

For daily operations, Sedgwick County EMS uses a proprietary computer-aided dispatch system along with the MARVLIS system to staff 15 posts throughout the county. The agency tracks and analyzes operational performance, call volume and type, cardiac arrest and survival rates, and financial performance metrics. GEOINT analysis is integrated into these metrics.

Sedgwick County also employs FirstWatch during Riverfest. FirstWatch provides real-time surveillance and analysis to warn agencies of trends and patterns in a selected area. It does this using “triggers,” a set of user-defined filter criteria tailored to the specific event. Various data sources can be integrated with FirstWatch, making it very useful for events such as the Super Bowl, large conferences, festivals, and more.

Using FirstWatch at Riverfest, Sedgwick County EMS sets a geo-fenced area within which the incident command is deployed. Bike, ATV, and other responder teams staff the event, and patients who need to be taken to the hospital are transferred to an assigned point at the periphery of the geo-fenced area.

Geospatial tools are critical to efficient EMS operations, even more so when everyday operations are complicated by a special event or disaster.

Hadley views acquiring and using these tools “not as a cost, but as an investment.” The return on investment for geospatial technology, he said, provides Sedgwick County’s residents with cost-effective, patient-centered emergency care.

to achieve improved outcomes. That we could potentially reduce mortality by relocating only two helicopter units was a very powerful finding.”

### COMMUNITY ENGAGEMENT

Focusing resources strategically to improve patient outcomes involves more than ambulance placement. According to the American Heart Association, more than 350,000 out-of-hospital cardiac arrests occur in the United States each year. Only 5.5 percent of these victims survive to hospital discharge. Improving survival rates from sudden cardiac arrest is a holy grail among the EMS profession, and providers are combining geo-location data, GIS modeling, and smartphone apps in this quest.

In Mississippi, American Medical Response analyzed new data for geospatial patterns, looking for hotspots associated with neighborhood type, rural versus urban patterns, and similar factors. In the Jackson metropolitan area, they discovered an association between citizen CPR/Automated External Defibrillator (AED) training and bystander CPR rates in certain neighborhoods. Since bystander CPR/AED use can double or triple the chances of surviving cardiac arrest, AMR increased outreach training to the areas with high arrest and low training rates. Improved bystander CPR and increased survival rates followed.

“So much can happen during the critical minutes of an emergency,” explained Michael Arinder, M.D., director of clinical services for the south region with American Medical Response. “We recognized that we had the ability to see what happens in the moments before the arrival of trained personnel and we decided to use that to better serve the community. We knew that if it saved only one additional life, it was worth it.”

This focus on bystander CPR/AED inspired PulsePoint to create a smartphone app suite to bring citizen rescuers to the cardiac arrest victim. The PulsePoint Respond app sounds an alert when a cardiac arrest occurs in a public place. Users in the agency-defined notification area will see the victim’s location on a map. PulsePoint Respond incorporates data from PulsePoint AED, a crowdsourcing app that allows users to report the location of AEDs in their community. The AED location data is made available in PulsePoint Respond after being verified by local authorities.

“PulsePoint is the marriage between technology and citizen engagement,” said PulsePoint spokesperson Shannon Smith.

To date, PulsePoint Respond has been activated more than 20,000 times and has more than 59,000 users.

### 911 FOR THE NEXT GENERATION

Crowdsourced traffic information is another valuable geospatial tool that can benefit the EMS community. Genesis PULSE, a vehicular tracking system used for dynamic deployment, exchanges data on road closures and traffic conditions with navigation app Waze.

Data after the first year of information exchange revealed that in 62 percent of cases Waze obtained accident notification up to 4.5 minutes faster than 911 centers. Although the implications are unsettling, Waze data provides PULSE users an advantage in rapid deployment—if, as in all GEOINT use cases, the data is accurate.

All geospatial data requires accuracy to be useful, but in public safety, accuracy can make the difference between

life and death. Leaders in the field consider this a primary public safety challenge.

“Geographic Information Systems, when coupled with first-responder missions, private industry, and public policy can improve operational understanding and help PSAPs (public safety answering points) create and maintain reliable, dispatchable address databases,” said Mike King, emergency call-taking and dispatch industry manager for Esri as well as a member of the National Emergency Number Association. “All three disciplines are necessary for true success.”

The Next Generation 911 (NG911) initiative, spearheaded by U.S. Department of Transportation, seeks to design an emergency communications architecture that will transcend current limitations. Wireless mobile devices, Voice over Internet Protocol telephoning, and other modern technologies have rendered the 911 call center system outmoded.

According to King, core GIS capabilities, wireless and broadband use, and 3D routing technology, particularly for indoors, will be incorporated into NG911, but the parameters and solutions are evolving with the initiative.

Startup RapidSOS hopes to end geo-location fuzziness with a database that seamlessly integrates with 911 call centers. A cellphone call to 911 will ping the RapidSOS database, and geolocation information will be supplied to the 911 center. In trials, RapidSOS provided more accurate geo-location information than the wireless carriers tested.

EMS relies increasingly on GEOINT to provide effective healthcare.

In the coming years, the technology will continue to evolve with the proliferation of predictive artificial intelligence and machine learning algorithms, according to Nikiah Nudell, chief data officer for The Paramedic Foundation and a board member of the National EMS Management Association.

“Geospatial intelligence has become a powerful worldwide tool for paramedic chiefs and the public health and safety officials they often work with,” Nudell said. “In an environment where limited resources are being used to respond to dynamic critical incidents, having full situational awareness from an historic and real-time perspective is powerful.” 🌐

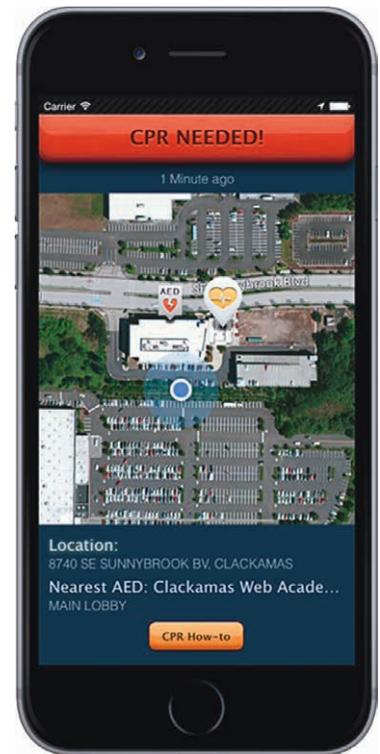


IMAGE COURTESY OF PULSEPOINT

*PulsePoint AED is a crowdsourcing app that allows users to report the location of AEDs in their community.*

# protected, co & *fully aware*

The DHS First  
Responders Group  
uses GEOINT to power  
the first responder of  
the future and build  
resilient communities

*BY KRISTIN QUINN*

# nnected,



## **IN 2013, 19 ELITE GROUND FIREFIGHTERS**—most of them less than

30 years old—were killed while battling the Yarnell Hill wildfire northwest of Phoenix, Ariz. The Granite Mountain Hotshot crew departed their safe zone and descended into rough terrain shortly before high winds whipped the fire into a deadly inferno. Investigators never fully determined why the crew was on the move, but many agree better situational awareness could've helped prevent this tragedy.



PHOTO COURTESY OF DHS S&T

A NASA Jet Propulsion Laboratory (JPL) engineer wears a prototype POINTER location device during testing at JPL labs in Pasadena, Calif.

Yarnell marked the nation's deadliest wildfire since 1933—and the U.S. Department of Homeland Security's (DHS) First Responders Group (FRG) aims to keep it this way.

The DHS Under Secretary for Science and Technology (S&T) stood up FRG in 2010. The group partners with first responders and emergency preparedness professionals at the federal, state, local, and tribal levels to develop innovative solutions to public safety challenges.

FRG Director Dan Cotter said his group strives to ensure first responders are "protected, connected, and fully aware."

In an ideal world, each first responder is fully aware with access to continuous information delivered in time to provide decision advantage. According to Cotter, geospatial intelligence (GEOINT) is instrumental in creating well-informed first responders and emergency planners.

FRG Chief Geospatial Scientist David Alexander said the group often meets with first responders to discuss their needs.

"The No. 1 worry pretty much boils down to 'Where am I? Where is my team? What is my proximity to hazards?' Those hazards are diverse and on the move," Alexander said. "... First responders work in a very dynamic environment and we're trying to get them the critical information they need to do their job effectively."

### INDOOR WAYFINDING

Most first responders lack the ability to transmit their location once they enter a building.

"Firefighters put a magnetic placard on a board that tells the incident commander they're in the building fighting the fire," said Bill Stout, deputy director of FRG's First Responder Technologies Division (R-Tech), which focuses on the rapid development of technologies for first responders. "Imagine if instead the incident commander was able to look at a viewer and tell at any given time where the firefighters are in that building."

A new geospatial technology might soon make this a reality. R-Tech has a major effort underway with NASA's Jet Propulsion Laboratory (JPL) to achieve high-fidelity indoor wayfinding for first responders. The POINTER (Precision Outdoor and Indoor Navigation and Tracking for Emergency Responders) project tracks first responders via low-frequency magnetic fields that can transmit through dense materials such as brick and concrete.

Andrew Wordin, a battalion chief for the Los Angeles Fire Department, said POINTER provides an enhanced degree of fidelity compared with current methods, including the ability to tell whether a first responder is standing or lying flat.

"This could be valuable information for an incident commander to make a decision to send rescue teams to a downed firefighter," Wordin said.

R-Tech leads solutions addressing identified capability gaps from development to prototype in less than 18 months, and has put through that process nearly 20 items that can now be purchased by first responders. With continued success, POINTER will soon be one of them. R-Tech anticipates POINTER will be commercially available in mid- to late 2018.

The POINTER project tracks first responders via low-frequency magnetic fields that can transmit through dense materials such as brick and concrete.

The prototype is undergoing three iterations of testing and is currently in Phase 3, which will include miniaturizing the transmitter to about the size of a smartphone and improving the technology to a range of up to 75 meters.

Although the testing focused on homes, warehouses, and buildings no taller than 12 stories, the goal is to be effective in buildings as tall as 100 stories or more. The technology will also be adapted for other types of first responders such as law enforcement.

### BUILDING RESILIENCY

Resiliency against disasters at the local level begins with first responders, especially when it comes to an effective emergency response that minimizes loss of life and property damage.

FRG created its Flood Apex Program in 2016 at the request of the Federal Emergency Management Agency (FEMA) with the goal to bring together new and emerging technologies to improve community resilience to flooding—America's most costly disaster.

GEOINT is a common thread across all aspects of Flood Apex, according to Alexander.

"Understanding the hazards in your community is a geospatial activity," he said. "When you combine land use, flood plain, meteorological, and elevation data, then you understand your hazard. The lack of detailed elevation data for the nation is the No. 1 gap we face when it comes to understanding flood hazards. If you understand where the hazard is you understand the locations at risk and can compare those with the locations of homes, critical infrastructure, and more."

The ability to predict which areas are most at risk could allow emergency planners to implement preventative measures such as increasing storm water capacity or changing building codes; to automatically know where to concentrate response efforts when an emergency occurs; and to encourage home and business owners as well as private critical infrastructure operators to invest in proper insurance and flood proofing.

"We're not going to prevent all floods but we can improve our ability to be resilient—to deal with the event

and bounce back,” Alexander said. “But we can’t fully model and anticipate the risk if we don’t use GEOINT to improve our predictive analytics.”

Following Hurricane Matthew in 2016, FRG began working with the State of North Carolina to determine how sophisticated 3D elevation data sets derived from LiDAR can improve the ability to understand flood risk. At the federal level, FRG is collaborating with NOAA’s Office for Coastal Management in Charleston, S.C., to model future conditions including potential effects of sea level rise at different depths, and to predict surge levels during extreme weather events.

In an embrace of emerging technology, the program is seeking inspiration from the Internet of Things (IoT) to construct a network of low-cost, disposable smart sensors. The rising water sensors will be deployed on critical infrastructure such as levees, dams, water storage systems, and low water crossings to automatically report when flooding is starting to accrue.

The disposable sensors could potentially cost less than \$1,000 each when brought to market—“orders of magnitude” less than permanent sensors, which can run upward of \$20,000, according to Jeffrey Booth, director of FRG’s Information, Applications, and Standards Division.

Eventually, FRG hopes these sensors will trigger automated alerts to individuals and help prevent flood-related deaths. For example, when a sensor detects flooding it could send an alert to all smartphones within a designated radius.

In addition to reaching individual citizens, these technological advances have the potential to transform how public works and utility providers support emergency management.

“Sensors placed with the right density can create a live map of where the water is,” said Mike Davis, smart alerts principal program architect with the Lower Colorado River Authority. “This allows first responders to focus their resources on areas affected by the event instead of trying to spread out and cover every possible scenario related to the flooding.”

Ultimately, the sensors are one of many initiatives under way to create the first responder of the future.

## THE FIRST RESPONDER OF THE FUTURE

How will future first responders analyze and make decisions based on the influx of information from smart sensors?

It all comes back to ensuring first responders are protected, connected, and fully aware, according to John Merrill, lead for FRG’s Next Generation First Responder (NGFR) Apex Program.

FRG is conducting exercises and researching technologies to mitigate the jamming of radio, GPS, and wireless communication systems. To facilitate better situational awareness, FRG developed a Next-Generation Incident Command System that manages and distributes real-time feeds such as vehicle locations, airborne images, video, weather, and terrain.

Looking to the future, NGFR hopes to ensure the viability of IoT to generate even more advanced situational awareness. Merrill’s team is working with the Integrated Justice Information Systems Institute and the Open Geospatial Consortium to develop and test architectures and standards to tailor IoT capabilities for first responders.

FRG is also harnessing artificial intelligence with the AUDREY (Assistant for Understanding Data through Reasoning, Extraction, and Synthesis) platform, being created in partnership with JPL.

“We’ve received a lot of feedback from first responders that they’re being inundated with data and they don’t know how to extract the information they need,” Merrill said.

Designed to act like a personal assistant, AUDREY will pull in data from various sensors and notify first responders to, for example, close a road, evacuate an area, or deploy resources to a certain location. AUDREY is also scalable, meaning those on the front lines see a more simplified version than those in the command vehicle, who see a less complex version than those at the command center.

“We know first responders are not analysts and we do not want them to be analysts, we want them to focus on their particular mission,” Merrill said.

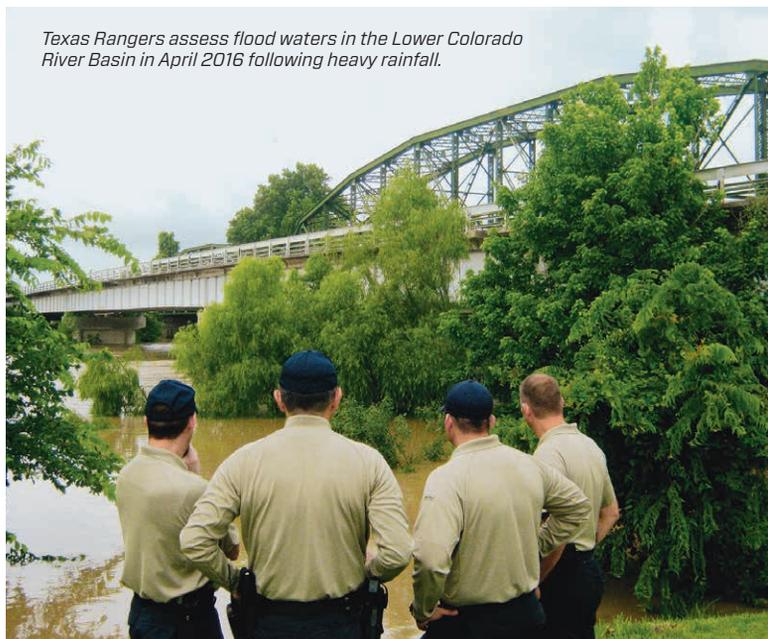
Cotter said he often tells the FRG team they must develop technology for those who are “tired, dirty, and hungry.”

“It means the technology has to be simple because the user may be on a 14-hour shift with little sleep,” Cotter said. “The device has to work even if it is dropped in the mud. It has to work well for someone who might be hungry, low on patience, or not feeling well. It has to be easy and intuitive because if they make a mistake—tell someone to go the wrong way or mark a map incorrectly—someone could die. That’s a pretty strong statement of requirements.” 🌐



Responders from Mesa Police Department in Arizona evaluate their communications during the 2016 First Responder Electronic Jamming Exercise at White Sands Missile Range, N.M.

PHOTO COURTESY OF DHS S&T

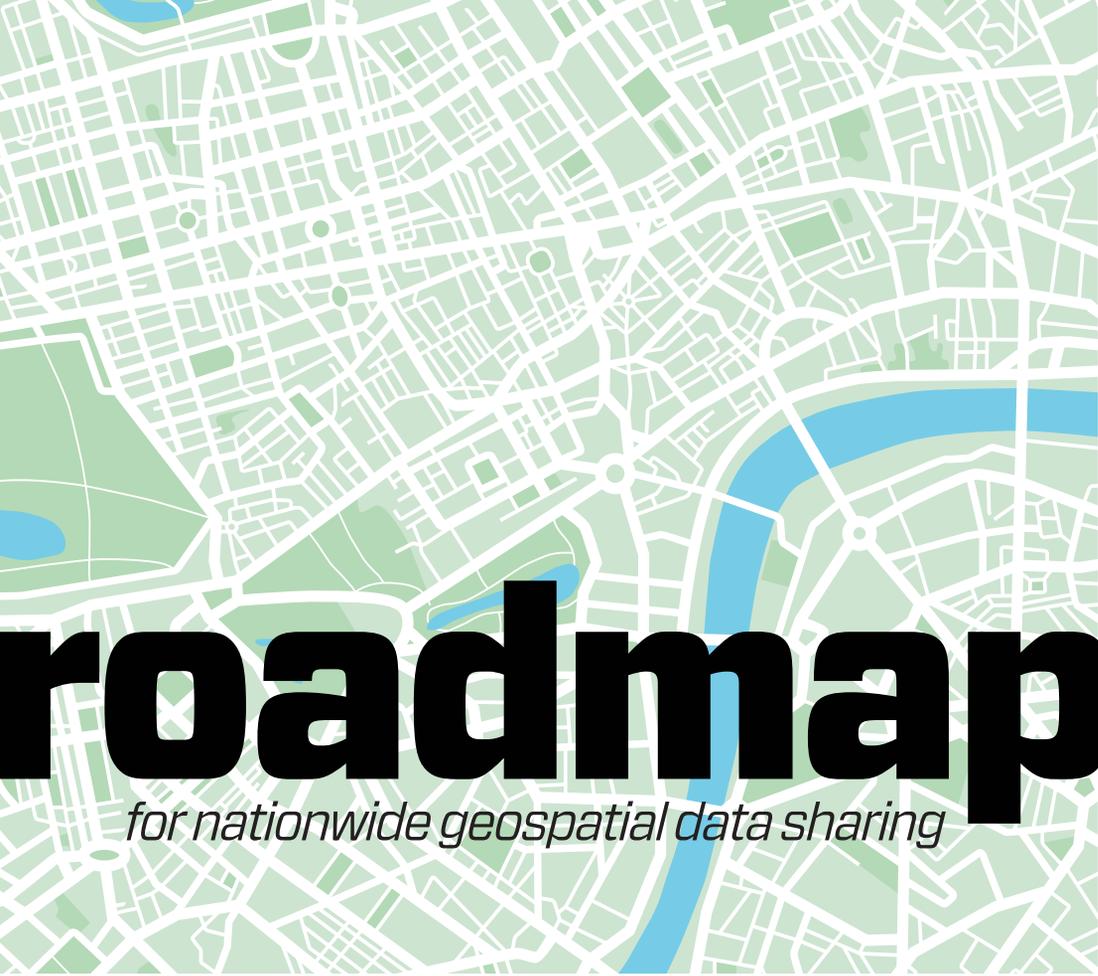


Texas Rangers assess flood waters in the Lower Colorado River Basin in April 2016 following heavy rainfall.

PHOTO COURTESY OF LOWER COLORADO RIVER AUTHORITY

There are a variety of ways to partner with the DHS First Responders Group. Contact [SandTFRG@dhs.gov](mailto:SandTFRG@dhs.gov) for more information.

An unabridged version of this article was originally published in the 2017 second quarter issue of *trajectory*.



# roadmap

*for nationwide geospatial data sharing*

**GeoCONOPS** is a guide to support homeland security, public safety, and emergency management

**BY JIM HODGES**



**LUKE MEYERS, A PLANNING COORDINATOR** with

Seattle's Office of Emergency Management, described himself as "a pig in mud" when he first learned about the Geospatial Concept of Operations (GeoCONOPS) at a conference in January. He has since taken three of four available online GeoCONOPS courses.

GeoCONOPS, overseen by the Department of Homeland Security's (DHS) Geospatial Management Office (GMO), is a strategic roadmap for national, state, local, private sector, and academic stakeholders to coordinate geospatial information, share data and tradecraft, and communicate in support of homeland security, public safety, and emergency management.

The roadmap is a guide for linking the geospatial data efforts of the 17 U.S. intelligence agencies, 22 DHS

components, and the 50 states, 3,114 counties, and 78 data fusion centers throughout the country, in addition to other data producers in major cities. GMO does not seek to own or hold the data, but rather to validate data and sources, then direct users to them.

David Carabin, Bryan Costigan, Aaron Kustermann, and Jay Moseley, who lead data fusion centers in Massachusetts, Montana, Illinois, and Alabama, respectively, hope GeoCONOPS will soon mature to support an idea they call "SitRoom."

SitRoom, according to Kustermann, would enable analysts at any of the nation's 78 data fusion centers to learn, for example, that an individual stopped for a broken taillight in California is driving a car stolen from Minnesota, wanted for drug trafficking in Chicago, and suspected to be part of a terrorist cell in New York.

"GeoCONOPS is how we're going to be able to share geospatial information," Kustermann said. "It sets the standards for our being able to share [data]. Without it, the puzzle can't be built."

#### **A MATURING CONCEPT**

Although the first version of GeoCONOPS was published eight years ago, public safety leaders like Kustermann and Meyers may have only learned of it recently or not be aware of it yet at all.

"It really hasn't been publicized a lot, at least on the state and local level," Meyers said.

Other leaders expressed some uncertainty as to which interoperability efforts fall under the umbrella of GeoCONOPS, which perhaps has too broad a definition for the far-reaching complexities of its mission.

"I'm not sure GeoCONOPS should be looked at as a specific program or policies to try to get to interoperability," said James McConnell, assistant commissioner of strategic data for the New York City Office of Emergency Management. "Sharing—we're doing a lot of that—but I'm not sure it falls under the title GeoCONOPS."

Yet when Hurricane Sandy struck New York and New Jersey in October 2012, the Federal Emergency Management Agency (FEMA) dispatched a GIS unit from Baltimore to assist in relief efforts. "They basically took a copy of our entire database, which



To learn more about GeoCONOPS, visit [geoplatform.gov](http://geoplatform.gov).

we were happy to give them, as their base for working in New York,” McConnell said.

GeoCONOPS has its roots in 9/11, when first responders lacked the maps and data needed to navigate the labyrinth of the Pentagon. Four years later, first responders viewed the aftermath of Hurricane Katrina via commercial satellite imagery, but lacked the tools to communicate about what they were seeing.

“I think that’s really when people started to wake up to this concept of location as a critical element of their operations,” said Chris Vaughan, then a FEMA first responder in New Orleans, and now the agency’s chief information officer.

The Hurricane Katrina disaster and others before it prompted a three-day meeting in Washington, D.C., of first responders, government, industry, and academia, that generated a 2007 National Academies report titled “Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management.”

The report acknowledged growing geospatial capability, but warned, “The effectiveness of a technology is as much about the human system in which it is embedded as about the technology itself. Issues of training, coordination, planning and preparedness, and resources invested in technology need to be addressed if future responses are to be effective.”

This statement embodies the intent behind GeoCONOPS.

“There was a feeling that we didn’t know what we didn’t know, and we had gaps we couldn’t identify,” said Nathan Smith, a contract program manager for GeoCONOPS. “A lot of that was a perception that geospatial wasn’t reaching its potential, and that it was constrained by a lack of coordination within the geospatial community.”

Published for the first time June 30, 2009, GeoCONOPS underwent six updates by Jan. 18, 2015, and was met with varying degrees of success. While federal agencies worked toward data sharing, many potential state and local stakeholders looked askance at the 228-page document from Washington. Today, GeoCONOPS is hosted online via [geoplatform.gov](http://geoplatform.gov). A second, more secure site is planned to facilitate shared access for more sensitive data.

“The moment something is printed, it’s obsolete,” said David Lilley, acting director of the GMO. “So we moved to the web, a dynamic mode of delivery, and it puts the content media in an environment that’s of more use to our readers. We are more able to keep the content current and add searches so users can drive directly to what they are looking for in a matter of clicks, instead of searching through 100 pages.”

### REALIZING WHAT COULD BE

Lilley is working to foster a more complete understanding of GeoCONOPS. According to him, GeoCONOPS not only shows how geospatial data is currently supporting the mission at hand—but what geospatial data is available to the community and how it could support other missions.

Realizing what “could be” is perhaps the most important message, especially for those with data that could help FEMA, or state and local governments who could benefit from sharing data with one another. Lilley’s outreach is bringing more data and registered systems into the GeoCONOPS community. In doing so, he seeks to foster a cultural change across all echelons.

“I think through GeoCONOPS, people are identifying the concept that ‘the more people are using my data, the better I can justify sustaining the program (that gleans the data),’” Lilley said. “That’s a fundamental shift, because it used to be that ‘my data is mine, my power is my information.’ They still control it, but letting more people into

the data makes it more powerful.”

Tightening budgets are also leading more partners to GeoCONOPS.

“People are more apt to re-leverage an existing capability for their mission need through the CONOPS than always building their own,” Lilley said.

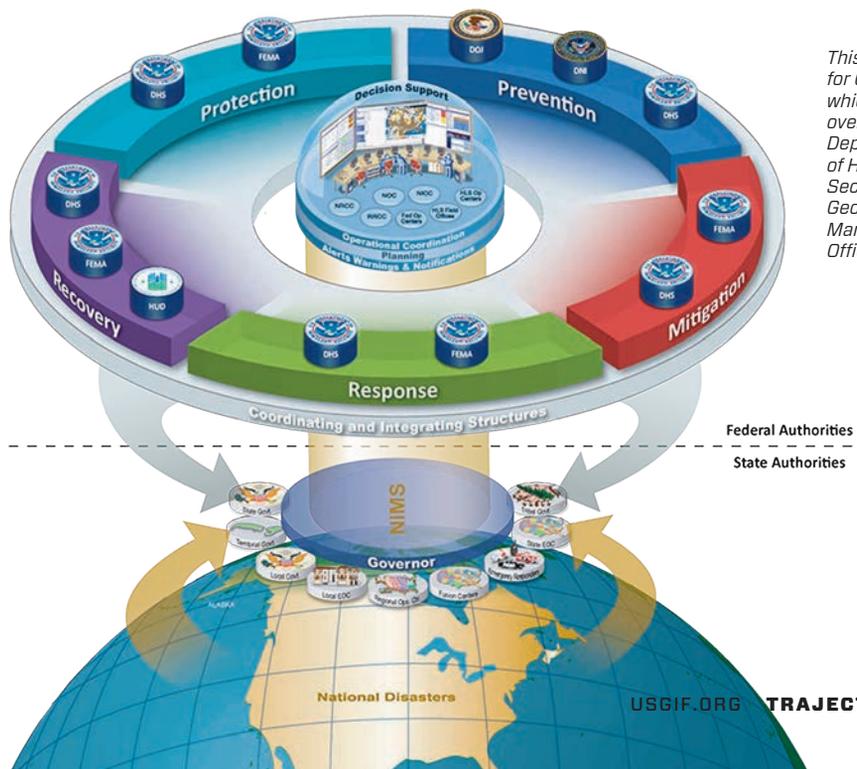
Monetary constraints, technological evolution, and more persistent threats are creating a public safety landscape ripe for more widespread adoption of GeoCONOPS.

“Technology became easier at about the same time data became more prevalent,” said Vaughan, adding GeoCONOPS has been prominent in FEMA exercises such as Gotham Shield, which in April simulated a nuclear explosion in the New York/New Jersey area.

At many levels, public safety experts said GeoCONOPS should also be used as a roadmap for preparedness and resiliency in addition to natural disaster response.

“If effective, [GeoCONOPS] is really being used to support preparedness activities—planning, exercises,” said Rebecca Harned, director of National & Federal for the National Alliance for Public Safety GIS (NAPSG) Foundation. “It’s not something you want to try to access for the first time when the ‘big one’ hits.” 🌐

Public safety experts said GeoCONOPS should also be used as a roadmap for preparedness and resiliency in addition to natural disaster response.



This is a model for GeoCONOPS, which is overseen by the Department of Homeland Security’s Geospatial Management Office.



**Lt. Joseph Flynn:**  
**Making GEOINT Connections**  
*How USGIF Membership is opening new doors for one Fairfax County law enforcement officer*

Lt. Joseph Flynn is assistant commander of the Fairfax County Police Department's Criminal Intelligence Division and deputy director of the Northern Virginia Regional Intelligence Center (NVRIC). In 24 years with the Fairfax County Police Department Flynn has held many roles—patrol officer, air and SWAT paramedic, and more. He also has held leadership positions in case and branch management. Recently, Flynn was elected chair of the Metropolitan Washington Council of Governments' Subcommittee for Intelligence. Since Fall 2016, Flynn has been an Individual Member of the United States Geospatial Intelligence Foundation (USGIF), an educational nonprofit comprising Individual and Organizational Members as well as volunteers.

To learn more about USGIF Membership, visit [usgif.org/membership](http://usgif.org/membership).

**Q** What led you to become a USGIF Individual Member?  
When I transferred into the Criminal Intelligence Division, one of the big

things I noticed was NVRIC analysts and staff were very isolated. The NVRIC itself has numerous analysts—cyber, critical infrastructure and key resources, threat assessment, gangs, narcotics. I wanted to see what else was out there in the intelligence world—other organizations or groups we could tap into to possibly expand our resources. Through the good graces of Google, USGIF came up.

I learned USGIF was very involved with the Defense Department and the federal side of geospatial technology, so I reached out to see if they would allow U.S. law enforcement into the organization and be interested in partnering with law enforcement agencies. My email received a prompt response from USGIF CEO Keith Masback, and he actually visited us with USGIF staff. They spoke with our analysts and our commander to explain what the Foundation does and to share more about some of the outlets they could provide to us. They also wanted to learn about the trends law enforcement is following with regard to GEOINT. I wanted my analysts to have opportunities for networking and outreach and to see other technologies out there that they may be unaware of.

**Q** How do Fairfax County police use GEOINT to prevent crime and protect the community?

We have several different layers of crime analysts throughout the county. A lot of stuff we do is related to GPS search warrant information we're allowed to receive from that type of data dump. We also use a lot of cellphone tower information when dealing with specific cases. For plotting information, we use a system called Tableau to highlight where events are happening.

There are two avenues we go down with geospatial information. The first is plotting an event and the historical marker of it. That information is used to help highlight, for example, whether the event occurred in a high accident traffic area. Then we'd push our efforts that way. Or to determine whether the event occurred in an area with high gang activity. We break it down into the specifics of the crime

and then determine what resources we're going to direct to that area to help reduce crime.

The second part of our geospatial aspect is plotting evidence data to reveal a timetable of how an individual person is moving and discover correlation between one or more targets to determine if there's a relationship. This is where companies are starting to come to us to see if they can help or if we can help them with a product that performs the geospatial evidentiary role.

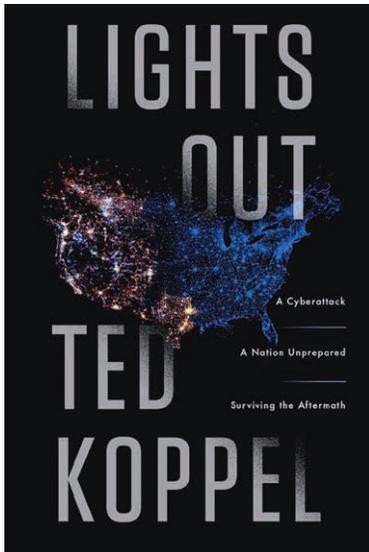
**Q** What advice do you have for students and young professionals hoping to join or who recently joined the law enforcement community?

Sit back and determine what type of law enforcement you want to do. I enjoyed starting my career as a beat cop, going out, pounding the street, driving, and meeting people and investigating certain levels of crime. There are those who want to go straight into working the crime scene processing or the forensics. You also have people who don't want to get their hands dirty but are very analytical and think deeply—the people that can correlate and see the bigger picture and bring it into perspective. Decide whether that's something you want to go into. Also, technology is still big in all aspects; you have to get very comfortable with the current technology and always think forward. If you're not doing that, you're going to handcuff yourself from advancing your career and your abilities.

**Q** How have you benefited from USGIF Membership?

Professionally, it's opening up eyes and doors. There are opportunities for law enforcement intelligence folks to meet and network with people who are experts in the field and are willing to assist us. I'm bringing geospatial intelligence specialists into NVRIC to talk with our analysts and to see how the workflows go and how they set their goals. Then, we can ask those outside groups for advice on how we can improve. USGIF is opening doors for us to people and technologies that we may not have thought of in the past. 🌐

## READING LIST



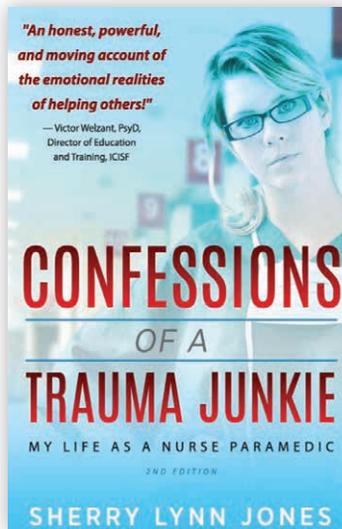
*Lights Out: A Cyberattack, a Nation Unprepared, Surviving the Aftermath*  
By Ted Koppel

This *New York Times* bestseller investigates the possible event of a major cyber attack on one or more of America's primary electric power grids. The potential consequences would be widespread. Without running water, sewage treatment, refrigeration, light, or internet, millions of Americans would be displaced, domestic industry would grind to a halt, and law and order would dissolve. This book evaluates how the United States should prevent and mitigate such a catastrophe.

*The Rise of Big Data Policing: Surveillance, Race, and the Future of Law Enforcement*

By Andrew Guthrie Ferguson

Just as big data is revolutionizing health care, banking, and retail, it is also creating a sea change in law enforcement. Algorithms predict crimes yet to happen, data banks collect and store open-source data, and software creates virtual suspect lineups. Such technology can be quite effective, but is it always just? This book raises questions about the ethics and constitutionality of big data surveillance, specifically regarding factors such as race and socio-economic status.



*Confessions of a Trauma Junkie: My Life as a Nurse Paramedic*

By Sherry Lynn Jones

There is much more to emergency response than what is taught during EMS training. The job involves trauma, tragedy, and often burnout. This book, penned by a nurse paramedic, discusses the empathy responders must possess to effectively treat vulnerable, scared patients as well as the emotional toll taken on emergency workers who are repeatedly exposed to traumatic situations. Jones bases her book on the varied personal experiences of talented medics, correctional officers, and caregivers worldwide.

## USGIF EVENTS CALENDAR

**NOVEMBER 11**  
**GeoGala**  
McLean, Va.

**NOVEMBER 13-17**  
**GEOINT Community Week**  
Northern Virginia

**NOVEMBER 14**  
**GEOINTeraction Tuesday**  
Chantilly, Va.

**JANUARY 8**  
**GEOINT Community Job Fair**  
Fairfax, Va.

**APRIL 22-25**  
**GEOINT 2018 Symposium**  
Tampa, Fla.

Visit [USGIF.org](http://USGIF.org) to learn more about the Foundation and its upcoming events.

# perspective

## THE FUTURE OF FIREFIGHTING

Kate Dargan is co-founder and chief strategy officer for Intterra Group, helping to bring innovative geospatial and remote sensing solutions to first responders. Prior to founding Intterra, Dargan was the first woman to become State Fire Marshal for California. She has 30 years of firefighting experience. Dargan is also a member of USGIF's Board of Directors.

**Q** What were some of your early experiences with geospatial intelligence (GEOINT) and firefighting?

One of my assignments was air attack officer, which means essentially forward air traffic control over wildfires. I flew on an OV-10 Bronco for seven years as an eye-in-the-sky translating a map of what I was looking at from several thousand feet to the firefighters on the ground. They had no other way to get that information.

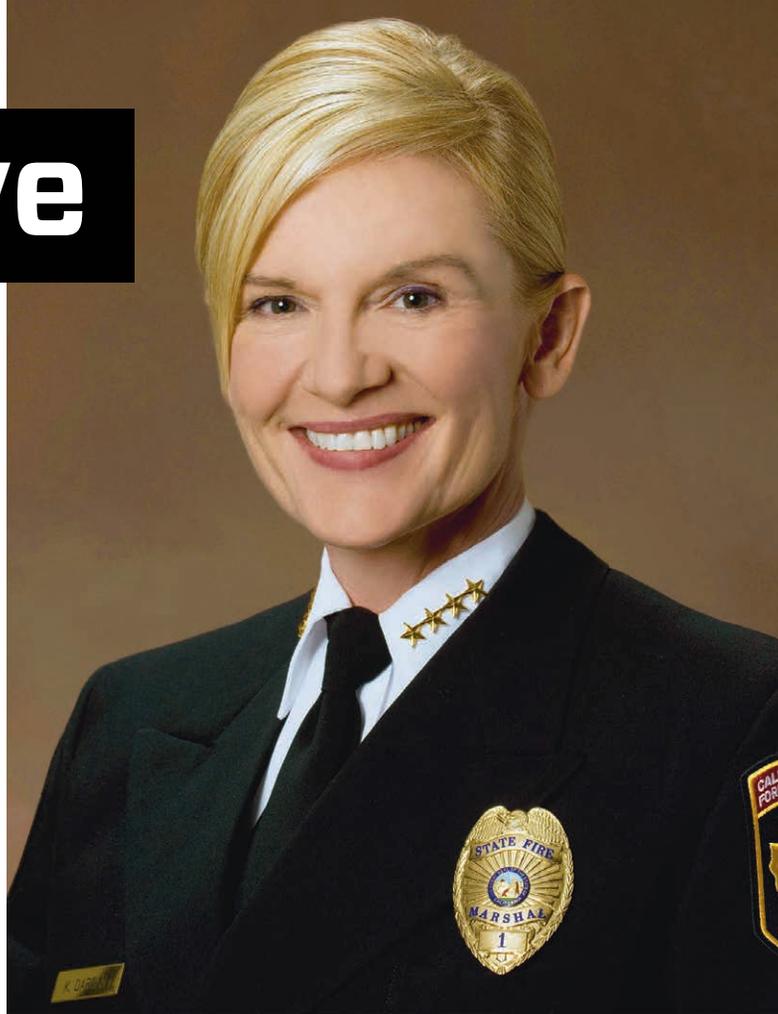
Some of the technologies that came online in the late '90s and early 2000s with infrared and mapping were making our world much easier. We experimented with holding a video camera in our hands while we flew so we could have video imagery. I gained a real sense of why we needed to be pursuing these technologies because so many things were advantaged with that perspective.

**Q** How did you gain an interest in community resilience?

In 2003, I was assigned to the Cedar Fire, which was one of California's historic loss fires. It burned a fair chunk of San Diego County and killed many people including some firefighters. It was a traumatic experience for everyone involved, and it generated in me a strong commitment to firefighter and community safety in firefighting and mitigation. I started looking for ways to use remote sensing for that problem as well.

**Q** How does GEOINT contribute to real-time firefighting and mitigation?

All phases of the emergency management cycle are advantaged with remote sensing. An example currently in use in the planning and mitigation phases is rooftop analysis. In the wildfire community, this allows you to assess a community's vulnerability without having boots on the ground. You can predict fire behavior close enough to the structure to impact it or to create embers that are going to flow downstream. You can mix vegetative information with building information from rooftops, then marry it with GIS information of



roadways, water sources, and historic fire information for patterns of behavior. When you put all of this together you have a tactically oriented map firefighters can use to decide which houses are safer to protect, which are riskier to protect, and where to stage equipment at the incident.

**Q** How does GEOINT yield a return on investment for fire departments?

The amount of detail a fire department can acquire and put to use through remote sensing is unavailable anywhere else except boots on the ground. We have the ability to take an aerial base map and electronically create that same building footprint or wildland area. It's not just a static, electronic picture. We can now add data and refresh during an emergency.

**Q** What do you anticipate for the future of firefighting technology?

Remote sensing products are arriving with exponential growth. So much of it is headed our way that the general public isn't even aware of yet. Those capabilities, whether it be

small drones or a large, near-real-time satellite network, are going to effect almost every moment of our decision-making process. A firefighter of tomorrow will be used to seeing their response area in an aerial viewpoint rather than through the windshield or via Google Earth. They will have constant access to what their district looks like at that moment, where they are within that area, where their adjacent units are, and the homes, building material, and emergency status in that area. They will be visually connected to their communities and will be much safer, especially in the wildland world. We've just begun to scratch the surface of how to incorporate these technologies into everyday decision-making.

**Q** What advice do you have for young public safety professionals?

Pay attention to GEOINT technology and become the person in your department who knows how to manage the information side. It's less about being able to control the drone itself and more about being able to interpret the imagery it's generating. 🌐

Visit [trajectorymagazine.com/perspective](https://trajectorymagazine.com/perspective) to read the extended Q&A with Dargan.

**SAVE THE DATE**

**USGIF**  
**geoint** 2018  
SYMPOSIUM  
**TAMPA, FLORIDA • APRIL 22-25**

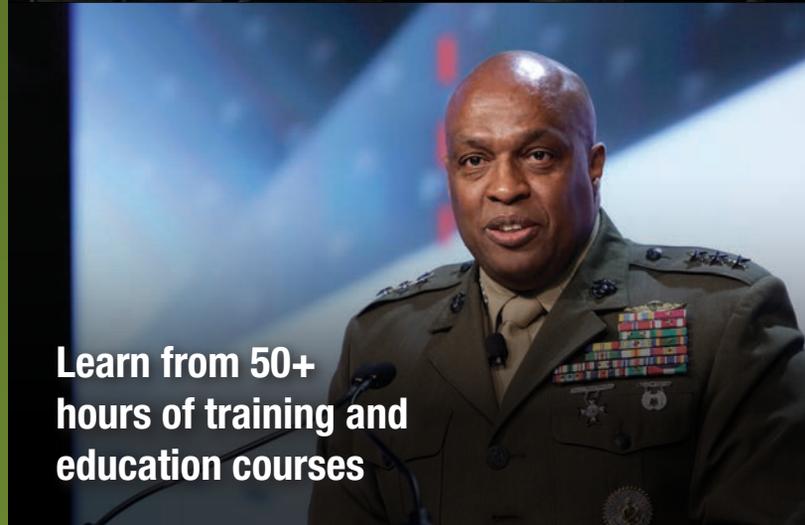
The annual GEOINT Symposium is the nation's largest gathering of industry, academia, and government to include Defense, Intelligence and Homeland Security Communities as well as commercial, Fed/Civil, State and Local geospatial intelligence stakeholders.



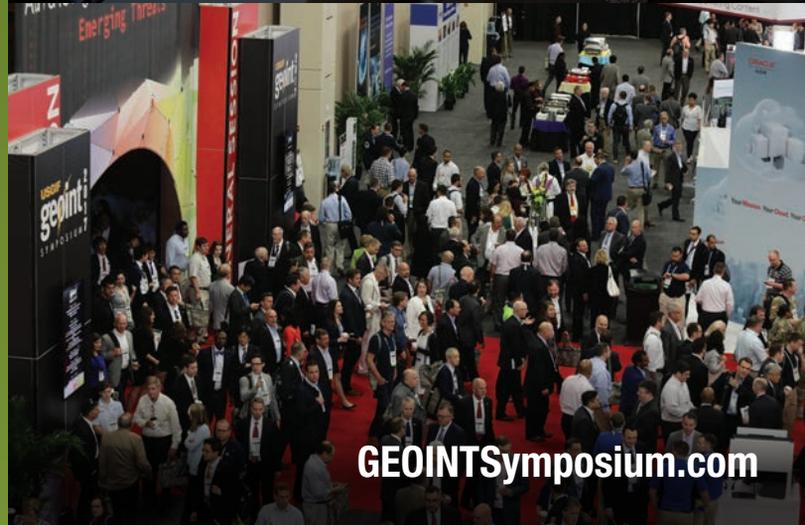
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