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EDITORIAL WHITEPAPER

# The big picture

Regional persistent surveillance  
comes into its own

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# Regional persistent surveillance comes into its own

BY ADAM STONE

**T**he need for situational awareness across broad geographies is nothing new for the military. Now, however, the civilian side of the government is finding the imagery technology and analytic tools that the military uses have applications away from the battlefield.

Homeland security, emergency management and law enforcement have all encountered a need for enhanced situational intelligence. As they come to understand their need for the tools, they also begin to recognize the challenges inherent in achieving the needed sophisticated level of surveillance. For homeland security trying to monitor an evolving situation, or emergency responders scrambling to take action in the wake of an event, conventional surveillance options have proven insufficient, while existing military-grade aerial surveillance tools have been too bulky and expensive to offer a practical remedy. Lately, though, a new class of solutions has emerged in the form of wide-area motion imagery (WAMI). Driven by this technology, regional persistent surveillance is coming into its own, delivering the close-up detail that drives pinpoint action while simultaneously offering the big picture view that encompasses a complex situation in its entirety. Those in the emergency response community say a civil implementation of WAMI technology would be a boon to their efforts.

“I could cite case after case, from Hurricane Sandy to the earthquake in Haiti, where you are sending teams into an environment where you can’t even give them a map because the street signs are gone,” said W. Ross Ashley, III, former executive director of the National Fusion Center Association, which represents state and local entities that pull together data and coordinate emergency response activities in times of crisis. “Would it be of immediate use? Yes,” Ashley said. In this paper we’ll look at some of the challenges facing law enforcement, emergency management and other civil agencies in need of higher-level surveillance tools. Then we’ll explore the emerging technology of regional persistent surveillance and the opportunities it offers for enhanced capabilities.

### CHALLENGES IN PERSISTENT SURVEILLANCE

- Terrestrial cameras offer too narrow a view
- Granularity: Aerial observation offers insufficient resolution
- Interoperability: Lack of communication between aerial and ground sensors

To understand the demands of persistent surveillance, it’s best to move from the general to the specific. What kinds of events will domestic agencies encounter that require imaging on a city-wide scale? Maybe the president is speaking, or there’s a political rally tying up a downtown area. A major sporting event draws tens of thousands. First responders need to get a visual read on a spreading fire. In all these cases, a similar set of challenges will arise. Typically authorities will likely have deployed dozens of security cameras. They’re cheap and easy to use, but they have a limited field of vision. A subject who steps out of range will disappear from view. There are also human limitations. It’s generally understood that someone watching a single video monitor for more than 20 minutes will lose 95 percent of their ability to maintain useful attention. While aerial surveillance may offer an alternative, present technology has proven insufficient to the task. Aerial surveillance generally cannot deliver on a wide-area scale, for example taking in an entire urban area in a single view in an ongoing manner. Users call this the soda straw phenomenon: Just as with cameras on the ground, a narrow field of view limits a responder’s awareness. Even from an aerial platform, it can be too easy for activity to slip out of the observer’s range of vision. Resolution has been an issue too, as has intelligence, the ability to analyze data in order to put it to practical use on the ground. The inability to take in a broad field can be especially challenging in efforts to prevent an event. Prevention suggests the need for persistent surveillance, the ability to watch the broadest possible area in an ongoing manner, determining suspicious activity not just at the center but along the periphery. Response meanwhile calls for greater granularity: Where were the bad actors standing and where did they go after the event? The military encounters

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analogous challenges in its need to survey a uniform landscape and pick out the anomalies.

### THE CHALLENGES OF OBSERVING AT SCALE

- Difficult to track multiple subjects of events simultaneously
  - Lack of intelligent handoff between multiple surveillance platforms
- To understand the challenges that can tie up surveillance in a domestic security situation, it's helpful to think in terms of scale.

Take the example of a dispersion bomb, a major explosive event in a crowded environment. Maybe security personnel have witnessed four potential suspects moving together, or a security camera has picked them up, with a sharp operator relaying the message to responders in near-real time. Now what? Here the problem of scale arises. A camera on the ground might catch a fleeting visual of a single individual. Uniformed and incognito personnel, placed to monitor and respond to events, may identify potential suspects. If three or four perpetrators move off in different directions, however, it rapidly becomes impossible to chart their diverging trajectories. Ground troops can't be everywhere at once, and even when activity appears and reappears on dozens of screens, the typical security camera array lacks the ability to stitch those images together to form a cohesive picture. Even when aerial surveillance is woven into the picture, responders come up short. Typically, aerial and ground systems have been unable to communicate. In most cases operators have lacked the analytic tools that would enable air and ground assets to form a seamless situational whole. The military has come a long way toward solving this problem, and civilian agencies may do well to look at those successes.

### MILITARY SOLUTIONS SUGGEST ALTERNATIVE TACTICS

- Persistent aerial observation
- High degree of granularity in video images
- Sophisticated analytics turn data into intelligence

Consider the emergence of WAMI. This type of sensor system can deliver high-resolution imagery of a city-sized area at two frames per second. Images can be streamed in real time to responders on the ground to improve situational awareness.

Driven by the power of WAMI, "You can have high resolution, you can track things with extreme precision. This kind of full motion

video will do that for you, with analytics to tie it together. That is the sweet spot," said Mike Hayes, director, regional persistent surveillance at defense contractor Harris. One notable example on the military side is the Air Force's Gorgon Stare program. The sensor system was first introduced in 2011 and has since logged more than 10,000 hours of in-theater operations in the Middle East. "[I]ts unrelenting gaze is turning thousands of terrorists into targets who can no longer elude U.S. weapons," Forbes reports. The system allows for surveillance "down to small details within the broader field of view, so users receiving images only seconds after collection could scrutinize items of immediate tactical interest."

Launched in 2014, an Increment 2 version of the system includes

daylight sensors derived from research funded by the Defense Advanced Research Projects Agency. The infrared cameras come from Exelis, which was acquired by Harris Corp. in 2015. Gorgon Stare can continuously monitor a city-sized area. While a powerful tool for military operations, Gorgon Stare has its limitations when applied to civilian uses. At 24 inches and 400 pounds, it's too big and too pricey for most domestic uses. Civil authorities suggest they would appreciate a use of the technology that was within their reach. The Iowa Department of Public Safety for instance has had some success with fixed-wing observation, but Director of Investigative Operations Jim

Saunders thinks things could be better. "We have had instances where we have put in tactical teams for search and rescue, where we would like to have a better sense of the topography," he said. "Technology that would provide that kind of information would be invaluable." Gorgon Stare developers say the technology could make a profound impact on civil operations. "With the size of the processing capability and the size of the field of view, you can have a larger context in order to move your critical resources, so you can respond in mission critical time," said Dave Bullock, vice president for Persistent Surveillance Systems at prime contractor SNC.

### THE LATEST IN REGIONAL PERSISTENT SURVEILLANCE

- Size, weight and price conform to civil agencies' budgets
- Record-and-rewind greatly enhances intelligence capabilities
- Automated analytics provide actionable intelligence in real time

It is helpful here to step back and look at WAMI as a general class of technology, and how it might be applied in the civil sector.

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In border patrol, for instance, authorities can use WAMI's wide, persistent view to decrease the number of illegal crossings and police pursuits. In homeland security, WAMI's ability to monitor dozens of locations simultaneously cuts down on the need for human operators, while developing a comprehensive situational picture. In the case of natural disaster, WAMI can track an unfolding event such as a wildfire with a high degree of accuracy. In law enforcement or humanitarian relief, WAMI's persistent view can help establish patterns of life, which in turn can help responders to target their efforts.

One real-world example comes from Harris, whose CorvusEye® 1500 series takes advantage of the promise of WAMI to deliver to the civil community many of the capabilities described above. Drawing from WAMI's implementation in Gorgon Stare, CorvusEye 1500 brings down size and weight considerably, to 15 inches and 83 pounds. Despite the scaling down, the sensor system still can maintain constant surveillance of an area over 3 kilometers in diameter. The system can then turn that data into actionable intelligence — a capability much coveted by the surveillance technology community. “Video doesn't lend itself to machine-based analysis,” Bullock said. “Being able to fully automate that process is probably the key to long-term success.” CorvusEye offers one example of a system that has moved aggressively forward on this front. The technology acts as an integral element in a surveillance architecture, forging a bridge between real-time observational data and input from ground stations, thus allowing them to work together to process, analyze and disseminate imagery. “That kind of situational awareness is huge. It's incredibly valuable to have something like that in real-time, in a way that is accessible to the people at the command centers,” said Major Steven Booker, Commander of the United States Park Police Icon Protection Branch, which safeguards monuments and memorials. “If you could look at a wider area and have good intelligence, that would give you a big advantage.” In tandem with powerful analytics, users also can set “watch boxes” or “trip

wires” in as many as 10 areas of interest. The system will send up an alert and automatically begin tracking when anything moves in or out of that area. CorvusEye also can cue a second sensor, such as a hyperspectral sensor, to scan a location for certain spectral “signatures” indicating the presence of a material or gas. Finally, it is worth looking at the emerging record-and-rewind capabilities to be found in today's cutting-edge persistent surveillance platforms. From an altitude of 15,000 feet, the CorvusEye system can record activity across the field of view, allowing operators to quickly rewind and review activities that may merit a closer look that would be possible in real time. Such a vital feature can help reduce overhead costs associated with staffing, while simultaneously delivering higher-quality intelligence.

### THE FUTURE OF SURVEILLANCE

While the military has done much to advance the state of persistent surveillance, the civil sector continues to wrestle with its own unique set of challenges. Law enforcement, disaster relief, homeland security — all may be faced with budget constraints at the state and local levels. Likewise, while large-crowd events, natural disasters and urgent law enforcement situations may demand a watchful eye, technology has not always risen to the demand.

Dozens of cameras can help, but mostly in a forensic sense, as a way to backtrack a wave of activity. They cannot do much in real time to help responders manage a situation unfolding in multiple directions, on multiple fronts. Aerial surveillance can help to get a bigger picture, but even this has its limitations, especially in the inability to “talk” to terrestrial systems. To unravel the knot, developers are turning to the technology of wide-area motion imagery, a well-tried and highly effective means of capturing real-time intelligence over a wide field. Paired with intelligent analytics, including the ability to record and rewind, WAMI is delivering the kind of fully realized surveillance civil authorities have been seeking in a world of increasingly complex threats.

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