Through-the-Wall Surveillance: A New Technology for Saving Lives

by Christopher A. Miles

About the Author

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Actor Kevin Costner said it best in the 2006 movie *The Guardian,* in which he played a legendary U.S. Coast Guard rescue swimmer. During a conversation with one of his young charges, he said, "There will come a time when you might have to decide who lives and who dies out there. It's a terrible responsibility, but it's one you will have to make . . . . The bigger reality is it's also something you are going to have to live with as a human being."

With life and death on the line, it is impossible to overstate the value of new technologies that save lives, especially when they reduce the risk to citizens, law enforcement officers, and soldiers. One such technology is through-the-wall surveillance (TWS).

TWS technology helps officers to determine if someone is in a room before putting themselves in harm's way and to save lives by using motion and images to differentiate between a hostage and a hostage-taker. It can also detect motion through floors and rubble following a building structure failure and, therefore, help in the search for survivors. It allows users to conduct room-to-room searches for suspected terrorists, map the interior of buildings, and find military combatants and weapons caches—all through an interior or exterior building wall. Certain TWS technologies do not even need to be placed against a wall and can be used to perform standoff searches, for example, from a vehicle into a building.

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EVALUATING THROUGH-THE-WALL SURVEILLANCE TECHNOLOGY

The National Institute of Justice (NIJ) is currently evaluating through-the-wall surveillance (TWS) technologies in a controlled environment. The Institute has funded the construction of test walls at the Air Force Research Laboratory in Rome, New York, where the efficacy of some TWS technologies is being tested. Such controlled evaluations set clear performance criteria, allow comparisons between systems that are commercially available, and define future research and development priorities.

NIJ also loans technologies to law enforcement and corrections officers for evaluation in real-world situations. These officers often find creative ways to use the technology not envisioned by the manufacturer or NIJ during development. Best-use practices are developed and passed on to other agencies. For example, the police department in Cobb County, Georgia, integrated the Time Domain Radar Vision TWS system with its Peace Keeper SWAT vehicle. The department installed the system on an articulated arm that can look through first- or second-story walls. Video transmits to the interior of the SWAT vehicle, allowing the viewer to remain in a safe location. Such evaluations provide law enforcement with hands-on use, the manufacturer with feedback on industry needs, and NIJ with invaluable information in setting research and development priorities for the future.

Value to Law Enforcement

In the field of law enforcement, the possibility of officer injury and death is all too real. In the decade between 1996 and 2005, more than a half million (566,626) officers were assaulted in the line of duty. In that same period, 575 officers were killed—19 of them during tactical situations involving barricaded offenders, hostage-taking, and high-risk entry.[1]

These situations involve the riskiest of conditions for law enforcement, and consequently, many agencies have specially trained emergency response teams (ERTs) or special weapons and tactics (SWAT) teams to handle them. ERTs and SWAT teams often have access to specialized firearms and weapons, heavy body armor and ballistic shields, equipment for forced entry, covert communications, video and audio surveillance technologies, and special vehicles that can help improve responses and increase safety.

TWS technology could undoubtedly help these men and women in the field (see sidebar on p. 22, "Through-the-Wall Surveillance: Reducing Risk to Law Enforcement"). With the potential benefits of this technology, however, come concerns about high cost, limitations in ability, and privacy and policy issues. These areas must be addressed to ensure that this technology is developed and implemented effectively to reduce the risk to law enforcement and save lives.

THROUGH-THE-WALL SURVEILLANCE: REDUCING RISK TO LAW ENFORCEMENT

Through-the-wall surveillance (TWS) technology could prove invaluable to law enforcement officers, particularly in high-risk situations involving hostages and barricaded offenders (see main story). The 2005 FBI Uniform Crime Report of Law Enforcement Officers Killed and Assaulted (www.fbi.gov/ucr/killed/2005/killedsummaries.htm) describes incidents in which TWS technology could have aided responding officers and perhaps saved their lives. Studying incidents like these provides insight into how technology and revised practices can enhance officer safety.

- On January 19, 2005, the 42-year-old sheriff of the Greenwood County Sheriff's Office (Kansas) was shot and killed while attempting to execute an arrest warrant. The sheriff, along with two deputies, arrived at a residence where they encountered two people who said that the subject of the warrant was not in the house. The two deputies secured the outside of the house while the sheriff, who had 26 years of law enforcement experience, searched inside. While the sheriff was standing near the staircase, the subject emerged from his hiding place, placed a revolver to the sheriff's chest, and fired twice.
- An officer with the Fort Worth Police Department (Texas) was shot on November 29, 2005, while attempting to arrest the alleged subject of a felony warrant. The 17-year veteran officer and two other officers arrived at a residence where they thought the subject was staying. A female met the officers at the door and told them that the man for whom they were searching was not inside. She invited the officers inside and gave them permission to search the rooms. As the officers approached a bedroom and opened the door, a man inside the room fired at them. In the exchange of gunfire that followed, the assailant shot the officer in the head. Two days later, the officer died.
- A young female called the Newton Police Department (Kansas) late on the evening of April 8, 2005, stating that her mother was engaged in a domestic disturbance with the mother's boyfriend, who was armed. ERT officials and hostage negotiators arrived at the scene of the declared hostage situation and established a perimeter barricade. The suspect denied that he had any weapons and agreed to a face-to-face meeting with the negotiators at the door of the residence. As ERT personnel escorted two negotiators, the suspect opened the front door, then slammed it shut after the female inside said something that angered him. Believing that the hostage was in imminent danger, officers forced their way inside. The suspect fired and mortally shot a deputy sheriff, the first ERT official to cross the threshold. The suspect then shot a detective, wounding him in the hands, arm, and leg.

Iraq: The War's Role in TWS Evolution

TWS technology typically has been developed for military use; however, it is now transitioning to law enforcement as costs have become more affordable. Although TWS has been the subject of research and development for the past 10 years, the war in Iraq has moved it to the forefront. The Defense Advanced Research Projects Agency (DARPA), the central research and development organization for the U.S.

Department of Defense, rapidly introduced the Radar Scope device, a portable handheld device designed to penetrate 12 inches of concrete and 50 feet beyond that into a room.[2] Barely larger than today's stud detectors, weighing only 1.5 pounds, and running on two AA batteries, the Radar Scope reliably detects motion as slight as breathing and transmits information on where in the room the motion is occurring. With a projected price of $1,000, this technology is expected to make a quick transition to SWAT teams and, most likely, to general law enforcement.

DARPA has also provided support for a larger SoldierVision device, which creates a two-dimensional color image depicting range and distance to objects in motion.[3] This device penetrates 60 feet into a room and has a standoff capability, allowing it to be 30 feet away from a wall and still penetrate 30 feet into the room. It can provide intensive target detection out to 9 feet, detecting someone hiding in a closet or a crawl space, for instance. Although the SoldierVision device does not comply with Federal Communications Commission (FCC) certification for use in the United States,[4] another version, the RadarVision2 device,[5] is FCC certified.[6] The range of the RadarVision2, however, is cut in half, providing a penetration of 30 feet into rooms. It also sells for more than $20,000, putting it out of reach for many law enforcement agencies.[7]

On the high-end of TWS capabilities—and price—is the Camero Xaver™ 800 product, which produces a 3-D display of a room in real time.[8] Full 3-D imaging can be accomplished up to 26 feet, and it has an extended imaging range of up to 65 feet. Operators can see not only the shape of the room, but also figures moving around or in one place within the room. A person's height and distance from walls or objects can be estimated quite easily. The system is generally considered too expensive for law enforcement. Its manufacturer is currently developing a Xaver™ T system, which should be lower in cost.

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Current Limitations of TWS Technology

Current TWS technology is limited in what it can do. Metal in walls and metal-backed insulation can block the ability to see into a room, and most TWS technologies provide a lower resolution image compared to video images. Each pixel in the TWS image represents an inch or more across the target, making it very difficult to differentiate between a cell phone and a handgun, for instance.

Although the ability to produce images of moving people, fixed objects, and room structure makes this technology very attractive to law enforcement, systems that offer an actual video currently are too expensive for police departments. Meanwhile, the less expensive systems provide only an indicator of motion on the other side of a wall—which, for example, could be an armed person or an animal.

Privacy Issues Exist

TWS technology raises significant privacy issues: Does it violate a person's Fourth Amendment right against unreasonable search and seizure?

In some situations, this technology would constitute an unreasonable search of a home unless a warrant with probable cause had been issued. The primary exception would be in emergency or exigent conditions. There is a significant

body of case law that describes such conditions; perhaps the clearest explanation is:

> A search is reasonable, and a search warrant is not required, if all of the circumstances known to the officer at the time would cause a reasonable person to believe that entry or search was necessary to prevent physical harm to the officer or other persons, the destruction or concealment of evidence, the escape of a suspect, and if there was insufficient time to get a search warrant.[9]

In tactical situations involving barricaded offenders and hostage-taking—situations in which there is not sufficient time to obtain a search warrant—it is fairly reasonable to assume that the use of TWS technology would prevent physical harm to an officer or other person. When serving high-risk warrants, however, it is not reasonable to assume that there is insufficient time to get a search warrant for a known address. In other words, even though serving a high-risk warrant may present a risk to law enforcement, the serving of the warrant is not typically time-critical. Thus, using TWS technologies to search a premises would require the appropriate search warrant under current legal precedent.

The use of TWS technologies in all situations must follow clearly defined policies and procedures that have been vetted by an agency's command and legal staff.

Federal Coordination

In the 1990s, the Technology Policy Council (TPC) was formed at the direction of the U.S. Attorney General to provide a forum for Federal agencies to share information about their research and development of law enforcement technology. Administered by the National Institute of Justice (NIJ), TPC provides an opportunity for agencies throughout the Federal Government to leverage projects, where it makes sense, to avoid duplication of efforts and to maximize the return on investment. The Deputy Attorney General serves as the chair of TPC.

At a December 2006 TPC meeting sponsored by the U.S. Department of Justice, representatives from several government agencies shared information on their TWS technology programs. The meeting revealed significant interest and investment in detecting objects and people in buildings and providing surveillance into a structure prior to entry. The meeting also revealed the need for standards and test protocols to ensure that:

- Performance is objectively measured and evaluated in the laboratory and in the field.
- Systems are interoperable with data-sharing and command and control environments.
- Performance objectives for future research and development are realistically set.

Federal agencies will continue to coordinate to ensure that they have identified and discussed the important issues surrounding privacy and human subject impact assessments. Without an upfront understanding of the legal and health implications posed by TWS technology, criminal justice agencies could face problems they had not considered—problems that may be easily avoided through coordination and policy planning.

Where to Go From Here?

TWS technology continues to evolve and improve. In July 2006, the Office of Naval Research initiated a Transparent Urban Structures program to collect and integrate information to determine the intent of above- and below-ground structures and quickly get the right data to the right user.[10] The program seeks to provide military personnel with an intuitive, portable interface that presents a clear, real-time picture of the battlefield and threats, likely enemy courses of action, and actionable intelligence of the situation surrounding them.

DARPA has a major program under way called Visibuilding, which is developing further technologies for sensing people and objects in buildings.[11] A key component of this project is making technology useful during a range of operations—from pre-mission planning to find which buildings should be searched, through post-mission analysis to find hidden objects or people.

NIJ is also working to advance TWS research, development, and evaluation through its sensors and surveillance portfolio and solicitation for proposals.[12] Through a 2006 solicitation, the Institute is funding a research project to add an acoustic TWS capability to the TimeDomain system, which uses ultrawide band radar TWS technology. Because radar currently is blocked by metal walls or aluminum-backed insulation, an acoustic capability would allow the TWS device to provide some surveillance capability to penetrate through those walls. A prototype system integrating radar and acoustic capabilities should be complete in early 2008.

As the capabilities, cost, and availability of TWS technology continue to improve, there will be many more opportunities to save lives by reducing the risk to law enforcement in tactical situations so that officers can make quicker, smarter, life-saving decisions.

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Notes

1. *Law Enforcement Officers Killed and Assaulted 2005,* U.S. Department of Justice, Federal Bureau of Investigation, October 2006: Tables 1, 20, and 65, available at www.fbi.gov/ucr/killed/2005.
2. More information on Radar Scope is available at www.darpa.gov/sto/smallunitops/radarscope.html.
3. More information on SoldierVision is available at www.radarvision.com/SoldierVision/sv.htm.
4. The FCC and the American National Standards Institute set limits for the safe amount of energy that can be emitted by devices for the operator and the individuals under surveillance. These limits are often not applied when devices are used overseas, so many of the companies sell a different, less-powerful version in the United States. The FCC requirements also ensure that the devices do not interfere with other communications devices.
5. More information about RadarVision2 is available at www.radarvision.com/RadarVision2/Rv2.htm.
6. This device is certified and complies with Part 15 of the FCC rules. Parties using this equipment must hold a license issued by the FCC to operate a transmitter in the Public Safety Radio Pool under Part 90 of CFR Title 47.
7. Enhanced Tactical Entry, ArmorOutlet.com, available at www.armoroutlet.com/AOtactical/AOtac_radar.html.
8. More information on the Xaver™ 800 is available at www.camero-tech.com/xaver800.shtml.
9. "The 'Lectric Law Library's Lexicon on Exigent Circumstances," 'Lectric Law Library, available at www.lectlaw.com/def/e063.htm.
10. Kruger, M., *Transparent Urban Structures Enabling Capability Program,* Office of Naval Research, available at www.onr.navy.mil/about/events/docs/83_TUS_Industry_Day_brief.pdf.
11. More information on Visibuilding is available at www.darpa.gov/sto/smallunitops/visibuilding.html. See also Baranoski, E.J., "Urban Operations: The New Frontier for Radar," in DARPATech 2005 Conference Proceedings, DARPA Special Projects Office, 2005, available at www.darpa.gov/darpatech2005/presentations/spo/baranoski.pdf.
12. For example, see "FY2007 Solicitation: Sensors and Surveillance Technologies," available at www.ncjrs.gov/pdffiles1/nij/sl000757.pdf.