Communication is the backbone of law enforcement. But even with all the communication technologies available today, one of policing's biggest problems has yet to be solved—interoperability—the ability of law enforcement and other public safety agencies at all levels to communicate across jurisdictions—a problem that has existed since the earliest days of radio communications.

But to tackle the issue of interoperability, the scope of the problem first needed to be assessed. This task was picked up by the National Institute of Justice (NIJ), which surveyed approximately 2,800 individual agencies through its National Law Enforcement and Corrections Technology Center (NLECTC)-Rocky Mountain, in Denver, Colorado.

The Study

“We asked more than 120 questions, which the statisticians said was pushing the limit,” says Tom Tolman, manager of communications technology at NLECTC–Rocky Mountain. “But the methodology worked! The result was an exhaustive look at communications, interoperability, and how individual agencies view or have handled interoperability problems.” Among the significant findings, Tolman says, were:

- “Dead spots” (specific locations where no radio transmission or reception is experienced) and outdated equipment were cited as the most serious and common communication problems.
- Channel congestion was also cited as a significant problem, especially for larger agencies and State police. Ninety-one percent of agencies reported a need for more channels—a 40-percent increase in voice channels and a 70-percent increase in data channels. Agencies that reported a need for more channels said a 40-percent increase in voice channels and a 70-percent increase in data channels would begin to alleviate channel congestion.
- The use of mobile computers and the transmission of images, fingerprints, and video is expected to double in the next 2 years. Within 5 years, many agencies plan to use cellular phones with greater frequency, and at least 40 percent said they expect to use global positioning systems. In short, the use of advanced technology, and therefore the need for additional frequencies, is expected to triple.
- Although most agencies have conventional analog systems and operate at the high end of the VHF band, almost half said they planned to upgrade in the next 10 years. The report predicted that those operating at 800 MHz will more than double these systems will increase from 13 to 25 percent; and those using digital systems will increase from 24 to 27 percent.
- The report also revealed a few surprises. The first, and possibly the most interesting, was that many local agencies see interoperability much differently than those at the Federal level. Local agencies reported they regularly communicate with neighboring municipal agencies. Less frequently, however, did they communicate with their State agencies, and only rarely with agencies at the Federal level. It seems that local agencies, in lieu of national interoperability standards, have instead relied on their own creativity to cobble together solutions. In fact, 82 percent said they have one channel dedicated solely to communicating with nearby organizations.

“Eighty-two percent is great,” Tolman says, “but it’s still only one channel. Denver, for example, is on the 800 frequency and can communicate with other agencies. But those agencies need 800 megahertz capability also. Many of the cities surrounding Denver operate on the 450 or 150 bands.”
Other "low-tech" solutions cited in the study include the use of walkie-talkies and scanners, posting representatives in a dispatch center to relay information, and issuing mobile radios to other agencies.

The second revelation in the report was the lack of awareness about communications technology, equipment, and industriewide standards. "Most agencies were unaware of the major sweeping changes the FCC [Federal Communications Commission] has been making with regard to spectrum," Tolman says. "The result is that these agencies are vulnerable. For instance, a new Denver television station tried to install a 5-million-watt transmitter. It was so powerful and so close to our public safety agencies that it would have created severe interference. And once you throw the switch on a television station, it's difficult to turn it off."

However, according to Tolman, because the agencies in the Denver area that would have been affected had a high level of awareness, they were able to keep it from happening. But, he says, the same thing happened in another State, only this time the affected agencies were unable to stop the station from starting up. In the end, the sheriff's department had to move.

Tolman says that the total radio spectrum, which represents 3,300 frequencies, is such a hot commodity that some commercial providers have offered thousands of dollars to police agencies, hoping to buy frequencies. According to Tolman, they have been known to approach some of the smaller agencies or cities and offer them $20,000 for a frequency pair. What the agency or city officials don't know is that frequency might have been worth as much as $250,000.

Many agencies, he says, were also unaware of the Project 25 Interoperability Standards, a set of voluntary standards created by the Association of Public Safety Communications Officials about 10 years ago. One of the goals of Project 25 is to stop the proliferation of proprietary protocols in communications equipment and to develop technical standards for the next generation of radios. But not all manufacturers have complied. The lack of industry cooperation has made law enforcement's awareness and acceptance of the standards agonizingly slow.

While the FCC's decisions have attempted to alleviate spectrum crowding, Tolman says that some of them have resulted in concern among law enforcement agencies, as evidenced by two of the interoperability study's major findings: Most departments said that if the Federal Government were going to set standards and require that agencies buy new equipment to comply, the Federal Government should also provide funding to defray the cost. The majority of agencies surveyed also preferred local planning, saying that they communicate primarily with local agencies, and less frequently with State and/or Federal agencies. Their confidence level in their ability to communicate with local departments under almost any conditions was high, while their confidence in their ability to establish radio communication links with State or Federal agencies was low.

**Study Into Action**

Published in early 1998, the study titled Wireless Communications and Interoperability Among State and Local Law Enforcement Agencies, has met with widespread interest from law enforcement, industry, and the FCC.

"The FCC, the Federal Emergency Management Association, and other public safety organizations approached us and said they liked the study so much that they wanted us to do a similar fire/EMS study," Tolman says. "We agreed, and have already developed a questionnaire and handed it over to the Public Safety Wireless Network, which is involved in the planning and development of a nationwide shared wireless telecommunications network for use by Federal, State, and local law enforcement and public safety agencies.

"We also want the study to be a useful tool for agencies when they go before their city council, when they're making buying decisions. They'll have evidence that the lack of interoperability is a chronic, nationwide problem, not just one agency complaining. The study can also be used as the basis of future legislation and radio spectrum decisions. It's a dissemination and a representation of a collective voice that says these are the problems—this is what's really happening out on the front lines."

In addition to the interoperability study, NLECTC–Rocky Mountain, through NIJ, is producing a video on interoperability for the Attorney General that provides an overview of interoperability and the public safety radio spectrum issues. The primary audience for the video is high-level State and local public officials who have a need to plan, design, and fund public safety wireless communications.

In addition, NLECTC–Rocky Mountain is conducting a study on commercial services available for the public safety telecommunications community. This will result in a useful guidebook that will help agencies determine if commercial services can fulfill any of their wireless communications needs, and how they would go about obtaining the best solutions.

Finally, because the interoperability study indicated a severe lack of knowledge and awareness of the problem within law enforcement communities, NLECTC–Rocky Mountain conducted a statewide Interoperability Forum for the State of Colorado this past May. The forum provided Colorado State public safety officials the opportunity to identify core communications issues and to learn about communications options available to them, such as additional frequencies. The meeting also provided a platform for officials to discuss possible actions to take, such as developing a State unified plan for conducting pursuits.

*For a copy of the study, Wireless Communications and Interoperability Among State and Local Law Enforcement Agencies, contact the National Criminal Justice Reference Service (NCJRS), at 800–851–3420. The study can also be viewed and downloaded by accessing the NCJRS World Wide Web site: www.ncjrs.org. For more information about the study itself or current interoperability projects, contact Tom Tolman or Robert Epper, NLECTC–Rocky Mountain, 800–416–8086.*
Thirty-plus years ago when police radios were underpowered and cumbersome, one officer voiced his frustration about his inability to communicate with his fellow officers this way: “Mission Control could talk to astronauts on the Moon, but we couldn’t talk to our partner around the corner, less than a block away.”

Sadly, when public safety agencies cannot communicate with each other or when communication links break down, the results can be disastrous—everything from confusion to loss of life. Illustrative of this problem was a pursuit that occurred in southern California involving numerous agencies, none of which could communicate with each other.

The incident started when an officer tried to pull over a vehicle for a traffic violation. When the driver refused to stop, the pursuit spilled over into the neighboring jurisdiction, and another officer joined the chase. Because the officers could not communicate with one another, they had to give information to their respective dispatchers, who then relayed it to the other jurisdiction’s communications supervisor, who then relayed it to his dispatcher, who then gave it to the officer. As the chase continued, units from two State and Federal agencies joined in, as did several more from neighboring jurisdictions. And even a local security guard switched on his lights and tagged along.

The second officer to join the chase described the scene: “Here we were, most of us not able to talk to one another, no one really had any idea who was involved in the chase or what their function was. We also had units from all over trying to join in the chase, which meant folks cutting one another off and forcing us to lose ground on the crook. And the crook was driving with that old ‘reckless abandon,’ which meant he was close to having a wreck.”

But police pursuits are not the only multiagency activity hampered by communications problems. When a fire broke out in northern California, response times were slowed because there was no common radio channel. The agencies that responded had to trade radios so they could communicate with one another. The lack of interoperability, which is the ability to communicate across jurisdictional boundaries, may get worse as agencies are increasingly called upon to cooperate in everything from pursuits to hazardous material (Hazmat) incidents, and from natural disasters to incidents of domestic terrorism.

The radio spectrum is analogous to the Oklahoma land rush of the late 1800s, when space was at a premium and everyone wanted to stake a claim to their own bit of land. Only today the land grab is actually an “airway grab”; radio frequencies are at a premium and everyone wants a claim on them.

The radio spectrum, which represents a range of roughly 3,000 frequencies, is like real estate—there is only so much ground to go around. This would not be a problem for our country’s skyrocketing use of personal communications devices such as cellular phones and pagers. To address the problem, the Federal Communications Commission (FCC) in the early 1990s decided to release for use various frequencies of the radio spectrum through auctions, instead of through lotteries or comparative hearings to assign licenses. This action precluded preferential treatment for public service agencies despite their mission of service to the public. Instead, the available frequencies were awarded to the highest bidder. The FCC has since raised some $12 billion and plans to continue auctioning off frequencies.

Much of the available spectrum has gone to personal communications service (PCS) providers or to those who provide frequencies for cell phones, pagers, and other wireless products. Law enforcement and other public safety agencies are feeling the squeeze as they try to adopt new technologies that allow the transmission of text and graphics, in addition to voice. In response to law enforcement’s demands and as a result of a 1996 study done by the Public Safety Wireless Advisory Committee, the FCC in late 1997 doubled the total frequencies available to public safety by reallocating television channels. Such action will help alleviate what has become a critical shortage of available frequencies, but it will not fully solve the problem.

Although today’s lightweight, programmable, portable radios have plenty of power to communicate within a department, modern technology is still struggling to find a way for neighboring departments to talk to one another without having to use multiple radios. One manufacturer tried solving the problem by building a repeater with cross-band capability into its mobile radio. The repeater allows the officer with a low-powered radio to extend his communication range while the cross-band capability allows communication across two specific frequencies. Currently, there are two manufacturers making dual-band radios that operate on 150 and 450 MHz. But the cost of these units, which can be as high as $3,000 each, may put it out of the financial reach of many agencies.

Another solution has been the move by some agencies to an 800 MHz system, which operates at a frequency higher than typical police radio frequencies. The advantage is that in emergencies, multiple agencies can be grouped on one channel if they are all using the 800 MHz frequency. The disadvantage is that these systems can be expensive, which could preclude smaller departments from implementing them. An 800 MHz system also may not have the range necessary for patrol officers unless the department installs a series of repeaters to pick up the signal and rebroadcast it, which constitutes yet another expense.

One positive note, the FCC has designated one national law enforcement emergency channel—at 155.475 MHz. However, the problem is that both law enforcement and public safety agencies need to have this frequency on their radios.

New Publications/Videos

The following publications are available from the National Law Enforcement and Corrections Technology Center—National.

**TechBeat**, Spring 1998. This issue of TechBeat features the use of telemedicine in corrections facilities, facial recognition technology, and thermal-imaging night vision devices.


The National Institute of Justice and Advances in Forensic Science and Technology. This bulletin presents information on recent advances in forensic science technology and evidence collection funded by the National Institute of Justice, including DNA identification, latent fingerprints, and questioned document examination.

Police Body Armor Consumer Product List Update Fall 1997. This consumer product list (CPL) identifies models of armor that were tested and found to comply with the NIJ standard. CPLs are updated to include new models that have passed the test. This edition is an update to the Spring 1994 edition of the CPL, both documents are required to have a complete listing of NIJ approved models.

**Equipment Performance Report:** 1997 Evaluation of Replacement Brake Pads for Police Patrol Vehicles. This report provides comprehensive evaluation of replacement brake pads for police patrol vehicles. The report contains a large amount of data generated throughout the evaluation, which was conducted under a variety of test conditions.

The following publications will be available soon:

**Survey of Commercially Available Explosives Detection Technologies and Equipment.** This document provides a comprehensive overview of currently available explosives detection methods and technologies. It is intended to inform law enforcement agencies about relevant aspects of explosives detection and provide them with a basis for making procurement decisions.

**Selection and Application Guide to Police Body Armor.** While body armor is not a requirement for every police agency community, questions about its selection and use are frequently asked. This guide responds to commonly expressed concerns and provides information to help determine the level of protection required by officers. Excellent companion publication to Police Body Armor Consumer Product List Update Fall 1997.

**Positional Asphyxia Videotape.** This informational videotape, targeted to the many smaller county municipal jail facilities throughout the United States, details actions to prevent in-custody deaths related to positional asphyxia. It highlights the correct procedures to use when restraining a violent prisoner and safety precautions to follow to prevent medical problems.

To obtain any of the above publications or videotapes and to receive additional copies of the TechBeat newsletter, write NLECTC, P.O. Box 1160, Roseville, MD 20849–1160; telephone 800-248-2742. Publications can also be downloaded from JUSTNET at http://www.nlectc.org.
as yet aware of any other groups that mix new technologies both in and out of the marketplace with prison riot training scenarios,” he adds.

Detective Ken Miller of the Parkersburg, West Virginia, Police Department and Dave Fromhart, a corrections officer at the Northern Regional Jail and Correction Facility, were in charge of the hostage negotiations. The “inmates” were led by WJU student Mike Oravec, a veteran of last year’s mock prison riot, and Eddie Littell, a West Virginia Division of Corrections officer, who brought real-life experience as a hostage to the event. Littell had been held captive for 14 hours at the West Virginia Penitentiary during the 1986 New Year’s Day inmate uprising.

More than 300 observers from numerous Federal and State corrections and law enforcement agencies, public and private organizations, and private companies attended this year’s riot event, including corrections officers from 38 States and three countries. More than 75 tactical personnel from Ohio, Pennsylvania, West Virginia, Puerto Rico, and the Federal Bureau of Prisons actively participated in the riot training scenarios.

For more information or a videotape about this year’s mock prison riot and the technologies demonstrated, contact Tom Burgoyne at OLETC, 888-306-5382.

First Technology Institute for Corrections

As part of a determined effort to promote effective and affordable technology in support of corrections, the National Institute of Justice (NIJ) will sponsor a Technology Institute for Corrections this fall in Washington, D.C.

Space is limited to 24 mid-level corrections practitioners who regularly deal with technology issues in their departments or agencies. The goals of the conference are:

- To provide participants the opportunity for continued education on technologies applicable to corrections.
- To provide participants the opportunity to meet and interact with other professionals and solve technological problems.
- To provide Nij the opportunity to improve its programs based upon participant experience, comments, and recommendations.

The first NIJ Technology Institute, focused on law enforcement, was held in August 1997. Its success led NIJ to schedule another conference for law enforcement this summer, and the first such Technology Institute for Corrections this fall.

The Technology Institute for Corrections is scheduled for October 25-30, 1998, in Washington, D.C. For information on the conference or to obtain an application, contact Ashley Mushett of Star Mountain, Inc., at 703-960-7000, or access the National Law Enforcement and Corrections Technology Center World Wide Web site, JUSTNET, at www.niectc.org.
The National Institute of Justice (NIJ), responding to recommendations by the law enforcement and corrections community, converted its Technology Assessment Program Information Center (TAPIC) into the National Law Enforcement and Corrections Technology Center (NLECTC) system. Created in 1994 as a component of the Office of Science and Technology, NLECTC’s goal, like that of NIJ, is to offer support, research findings, and technological expertise to help State and local law enforcement and corrections personnel more efficiently do their jobs.

NIJ’s NLECTC system consists of facilities located across the country that are colocated with an organization or agency that specializes in one or more specific areas of research and development. Although the NLECTC facilities are engaged in different technology focus, they together work to form a seamless web of support, technology development, and information to help the law enforcement and corrections communities do their jobs more safely and efficiently.

NLECTC–National
2277 Research Boulevard • Rockville, MD 20850
Phone: 301–515–5149 • E-mail: asknlectc@nlectc.org

The National Center, located just 30 minutes north of Washington, D.C., is the hub of the NLECTC system. It provides information and referral services to anyone with a question about law enforcement and corrections equipment or technology. Its staff manages the voluntary equipment standards and testing program that tests and verifies the performance of body armor, metallic handcuffs, shotguns, and police vehicles and tires. This office produces consumer product lists and equipment meeting a specific set of performance standards and also operates JUSTNET (Justice Technology Information Network), an Internet World Wide Web site that provides links to the entire NLECTC system and other appropriate sites, as well as assistance to those seeking information about equipment, technology, or research findings.

NLECTC–Northeast
316 Bedstone Parkway • Rome, NY 13441
Phone: 888–338–0584 • Fax: 315–330–4315 • E-mail: nlectc.ne@fi.edu

NLECTC–Northeast is located at the Rome Laboratories on the grounds of the Griffiss Business and Technology Park (formerly Griffiss Air Force Base). The center sponsors research and development efforts into technologies that address command, control, communications, computers, and intelligence. This center draws on the expertise of Air Force scientists and engineers in its development of technologies that can be used to detect concealed weapons on people, an effort that is expected to yield a stationary device for use in buildings and handheld devices for patrol officers. Other areas of research and development include the creation of an automatic booking system, automated firearms identification, multiband multifunction radios, transportable communication systems, and a computerized automatic language translation system.

NLECTC–Southeast
7325 Peppermill Parkway • North Charleston, SC 29418–1404
Phone: 800–292–4285 • Fax: 803–207–7776 • E-mail: nlectc.se@nlectc.org

Two of the focus areas of NLECTC–Southeast are corrections technologies and surplus property acquisition and distribution for law enforcement and corrections. The center facilitates the acquisition and redistribution of Federal surplus/excess property to State and local law enforcement and corrections agencies. The equipment must be used for law enforcement purposes only. Utilizing the JUSTNET Web site, the center educates law enforcement and corrections professionals about Federal surplus and purchasing programs. The efforts of NLECTC–Southeast have resulted in agencies receiving equipment they would not ordinarily have access to or might not have been able to afford due to budgetary constraints. This facility also studies the needs of correctional facilities. It serves as the mission by a committee of criminal justice, law enforcement, and corrections practitioners that identifies requirements and sets priorities for research and development. NLECTC–Southeast is allied with the South Carolina Research Authority (SCRA) and the Naval Command, Control and Ocean Surveillance Center In-Service Engineering, East Coast Division (NISE East). NLECTC–Southeast’s other areas of focus include information management and technologies, simulation training, and designated special projects.

NLECTC–Rocky Mountain
2050 East I-25 Front • Denver, CO 80208
Phone: 303–871–2522 or 303–871–2500 • E-mail: nlectc.rm@du.edu

Located at the University of Denver, NLECTC–Rocky Mountain focuses on communications interoperability and the difficulties that often occur when different agencies and jurisdictions try to communicate with one another. This facility works with law enforcement agencies, private industry, and national organizations to implement projects that will identify and field test new technologies to help solve the problem of interoperability. NLECTC–Rocky Mountain also houses the newly created Crime Mapping Technology Center, the training and practical application arm of NIJ’s Crime Mapping Research Center, which is staffed by NIJ social scientists and scholars who utilize crime analysis research to improve police crime-mapping and the development of crime-mapping software for small, medium, and large departments. The Rocky Mountain facility also conducts research into ballistics and weapons technology, as well as information systems. Sandia National Laboratory has been designated as a satellite of NLECTC–Rocky Mountain. The laboratory works in partnership with NLECTC–Rocky Mountain and focuses on technology for detecting and neutralizing explosive devices (Operation Albuquerque).

NLECTC–West
2350 East I-25 South Boulevard • El Segundo, CA 90245–4691
Phone: 888–548–1618 • Fax: 310–336–2217 • E-mail: nlectc.west@w.net

NLECTC–West is housed on the grounds of The Aerospace Corporation, a nonprofit corporation that provides technical oversight and engineering expertise to The Air Force and the U.S. Government on space technology and space security systems. NLECTC–West draws on The Aerospace Corporation’s depth of knowledge and scientific expertise to offer law enforcement and corrections the ability to analyze and enhance audio, video, and photographic evidence. In cooperation with The Aerospace Corporation, this NLECTC facility also has available an extensive array of analytic instrumentation to aid in criminal investigations, such as a scanning electron microscope, an x-ray microprobe, and a mass spectrometer, all of which are used to process trace evidence. Its other areas of expertise include computer architecture, data processing, communications systems, and a recent effort to identify technologies to stop fleeing vehicles.

Border Research and Technology Center
225 Broadway, Suite 740 • San Diego, CA 92101
Phone: 888–656–BRTC (2782) • Fax: 888–660–BRTC (2782) • E-mail: brtchrisa@aol.com

The Border Research and Technology Center works with the Immigration and Naturalization Service, the U.S. Border Patrol, the U.S. Customs Service, the White House Office of National Drug Control Policy, and the U.S. Attorney for the Southern District of California to develop strategies and technologies that will facilitate control of the Southwest border. One of its most recognized accomplishments has been the implementation of SENTRI (Secure Electronic Network for Travelers’ Rapid Inspection), which allows certain qualified individuals who enter and exit the country through special lanes at the U.S.-Mexico border to do so within 72 hours of their entry or exit without undergoing personal inspection. BRTC also works on joint ventures to identify technologies that will stop fleeing vehicles and is currently participating in a project to detect the heartbeats of people concealed in vehicles or other containers.

Office of Law Enforcement Standards (OLES)
National Institute of Standards and Technology, Building 225, Room A233 • Gaithersburg, MD 20899
Phone: 301–975–2757 • Fax: 301–948–6978 • E-mail: oles@nist.gov

Supported by NIJ, the Office of Law Enforcement Standards applies science and technology to the needs of the criminal justice community. While its major objective is to develop minimum performance standards for equipment and technology, which NIJ promulgates as voluntary national standards, OLES also undertakes studies leading to the publication of technical reports and user guides. Its areas of research include clothing, communications systems, emergency equipment, investigatory aids, protective equipment, security systems, vehicles, and weapons. It also develops measurement methods for analytical techniques and standard reference materials for forensic scientists and crime labs. Since the program began in 1971, OLES has coordinated the development of nearly 200 standards and related documents. OLES maintains the justnet website to provide information and referral services to anyone with questions about equipment, technology, or research findings.

Office of Law Enforcement Technology Commercialization (OLETC)
Wheeling Jesuit University • 316 Washington Avenue • Wheeling, WV 26003
Phone: 888–306–3582 • Fax: 304–243–2311 • E-mail: olotec@wju.edu

Housed at Wheeling Jesuit University, the Office of Law Enforcement Technology Commercialization provides one of the NLECTC system’s most important services, that of bringing research and private industry together to put new technologies into the hands of law enforcement and corrections. OLETC actively solicits manufacturers to participate in the technologies based on requirements identified by law enforcement and corrections practitioners. For example, it is currently seeking companies interested in commercializing technologies already developed by the U.S. Department of Energy’s Los Alamos National Laboratory, such as a device that lets police officers detect crack houses from a distance, microwave and acoustic sensors, and portable DNA analyzers. Housed at the National Institute of Standards and Technology, OLETC works closely with NLECTC–National to conduct tests and to guarantee the performance and quality of equipment used by police and corrections.

National Center for Forensic Science
University of Central Florida • P.O. Box 162367 • Orlando, FL 32816–2367
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The newest addition to the NLECTC system, this facility is housed in the University of Central Florida and will initially focus on arson and explosives research. Research mission is to conduct fundamental research into the basic nature of fire and explosion reactions, provide the support for developing standard protocols for analyzing arson and explosion debris, promote the use of electronic media to access and exchange information about the forensic sciences, and provide education opportunities to practicing professionals and full-time students. This new facility will draw on the experience and expertise of the university, which houses a forensic science program with an active research program, as well as the Institute of Simulation and Training, which is currently exploring ways to simulate explosive reactions to study various chemical processes.
he National Institute of Justice (NIJ) has long believed that one of the most vital aspects of its program is the solicitation of ideas and suggestions of criminal justice practitioners. It is this information that forms the framework of NIJ’s work. NIJ’s Office of Science and Technology (OST) and its National Law Enforcement and Corrections Technology Center (NLECTC) system get this information through conferences, regional workshops, and, most especially through a series of advisory groups. These groups are composed of representatives from all areas of law enforcement, corrections, and the forensic sciences, and focus on every aspect of operational technological needs to liability issues and public acceptance of these new technologies.

One such group, the Law Enforcement and Corrections Technology Advisory Council (LECTAC), is a group of criminal justice practitioners who serve as advisers to the NLECTC system and recommend program priorities. Because LECTAC’s members are also the users of new technologies, they keep the NLECTC system in touch with the realities of the street by bringing the immediate needs of police and corrections officers to the attention of staff, who then pass them on to researchers, scientists, and engineers.

LECTAC’s current list of research priorities include the development of technologies in the areas of concealed weapons and contraband detection, vehicle-stop, enhanced DNA testing, officer protection, less-than-lethal tools, information management, counterterrorism, location and tracking, secure communications, and noninvasive drug detection. Following are updates on several sample projects that fall under these headings.

Through-The-Wall Surveillance System. This device uses radar to locate and track an individual through concrete or brick walls. It is a portable, briefcase-sized system originally developed by Raytheon Company (formerly Hughes Missile Systems), and is a modification of an existing commercial motion detector sold by Hughes. The system was successfully demonstrated with the Los Angeles County Sheriff’s Department and the Albuquerque Police Department under quasi-operational conditions. It consistently tracked the activity of an individual moving behind an 8-inch-thick concrete wall to a range of about 75 feet from the radar. NIJ plans to procure a number of these devices for operational evaluation with law enforcement agencies in 1998-1999.

Ring Airfoil Projectile (RAP). The RAP is a rubber ring that weighs about 1 ounce and looks like a napkin ring. Fired from an M-16A1 rifle, the nonlethal RAP flies straight and fast (185 to 210 feet per second). With NIJ funding, the RAP is undergoing further development so it can be used by State and local police in crowd control situations, including its use as a vehicle to deliver pepper spray. An effort is also focused on finding a new delivery/launching system, rather than the M-16 rifle.

Smart Gun. No greater risk attends police work than a struggle during which an offender takes the officer’s gun. NIJ’s Smart Gun project is developing technology through which an officer’s gun will only “recognize” its authorized user and become inoperable in the hand of any other person. Colt’s Manufacturing Co., Inc., has come up with a prototype that puts a transmitter on the officer’s wrist. Using radio frequency identification, the weapon recognizes only the coded signal sent by the transmitter. Colt and NIJ are working with Smartlink, a company that specializes in biometrics and “smart cards,” to miniaturize the transponder chips and circuits required for the weapon to work.

Advanced Body Armor Inserts. This project is a collaborative effort among NIJ, the U.S. Army Soldier Systems’ Command, U.S. Army Research Laboratory, and the Defense Advanced Research Projects Agency to develop lighter ballistic inserts for tactical body armor that will stop armor-piercing bullets. Two contractor teams undertook this development effort: Allied-Signal and Simula, Inc. Both teams used a ceramic-composite insert; the ceramic breaks the bullet while the composite material, the plate or backface, “catches” the pieces. Testing indicated a 30-percent improvement in performance against a 7.62mm armor-piercing bullet, compared to the ballistic gel performance of the current U.S. Army composite inserts for Tactical Body Armor System. The U.S. Army Soldier Systems’ Command will test the prototypes and make a final evaluation as to performance by the end of this year.

Voice Response Translator (VRT) Device. This device, developed under an NIJ grant using Office of Community Oriented Policing Services (COPS) funding, is based on the officer’s belt, and lets an English-speaking officer communicate with people who have difficulty with or cannot comprehend English. Commands are given in one of three languages and are designed to elicit the appropriate physical response or gesture. Using the device, officers can query, inform, and direct the actions of non-English-speaking persons. Officers can choose any of three different languages with a simple voice command. The use of voice-prompted commands makes the VRT capable of hands-free operation.

Intended for use in both routine and emergency encounters, the VRT was developed by Integrated Wave Technologies. Prototype devices capable of more than 500 Cantonese, Spanish, and Vietnamese phrases have been tested by the Oakland, California, Police Department (OPD). OPD evaluated the relevance of the phrases, the post-translation appropriateness of the phrases (i.e., from English), and the ergonomic aspects of the device’s physical configuration. OPD also assessed citizen and community group reaction to the VRT. Prototype VRT devices are currently about 5 by 2 by 1 inches in size and use affordable electronic components that can be easily miniaturized. Future prototypes will likely be reduced to the size of a handheld calculator.

Laser Dazzler. This handheld device uses a random flashing green light to disorient and distract a subject. The current prototype is 24 inches long, weighs 4.8 pounds, and looks like a flashlight. From its 2.7-inch diameter lens, it emits a green laser that can distract, disorient, or temporarily immobilize a suspect or a crowd. To the subjects, it appears as if the flashing light is random and coming from all directions, not from a single source. This has the effect of creating an “optical wall” of light between police and the subject. The police can see everything, but the subject cannot see past the wall. According to the developer, the officer can walk right up to a suspect, and the suspect will never see the officer coming. The dazzler, which is not on the commercial market yet, works in any weather, and from 50 to 200 meters. It is eye-safe at the aperture, with no stand-off range. The device is seeing pilot projects testing and eye safety certification, which will clear the way for the dazzler’s demonstration and evaluation by the military. The project was funded by NIJ and the Defense Advanced Research Project Agency through the Joint Program Steering Group. Certification data also will be made available to NIJ so it can determine whether it will endorse similar testing by the dazzler by police agencies.

Utica Arson Strike Force. The Utica Arson Strike Force was assembled in April 1997 to combat a critical arson problem in Utica, New York. The problem was so severe that Utica was the only northern city to be included in the National Arson Initiative, which covered the States where church fires were set in 1996. The strike force consists of Federal, State, and local law enforcement agencies, and State and local fire agencies, organized into existing Strike Force teams to perform cause and origin analysis and provide technical support. NIJ is NLECTC-Northeast office in Rome, New York, provided a local area network and technical support to establish a model investigative strike force as a demonstration site for the rest of the country. Prior to April 1997, Utica’s arson closure rate was 2 percent (the national average is 15 percent) Utica is now approaching a 60 percent closure rate, with a 100 percent conviction rate.

NLECTC-Northeast is continuing to monitor the computer network used by the Arson Strike Force so it can be used as a model for other investigative teams. The Arson Strike Force currently uses the computer network for preparation of court documents, e-mail communication, and Internet access. The initial success of the Arson Strike Force was so overwhelming that old cases were reopened and closed by arrest. To better share information, the strike force members also developed a shared database concept that includes the necessary CAD/RMS (computer-aided dispatch/records management systems) infrastructure to facilitate the sharing and analysis of information between agencies in four central New York counties. The model of the strike force also is being adapted for a drug task force.

Explosive Diagnostic System. This project brings together NIJ, the U.S. Departments of Justice and Defense, and the FBI to demonstrate and evaluate improved diagnostic systems for explosive devices. The first technology being evaluated is the RTR-3, a computer-based portative x-ray system that enables the diagnosis of explosive devices in real-time. It also enables the transmission of x-ray images of those devices, via modem, to remote experts for analysis. Agreements currently are being developed with 24 State and local agencies to evaluate the RTR-3. Also supporting the project is the Naval Surface Warfare Center, Indian Head Division, and Naval Office of Special Technology.

For more information on NIJ law enforcement and corrections technology projects, visit the NLECTC World Wide Web site, J USTNET, at www.nlectc.org, or call NLECTC-National at 800–248–2742.
Wanted: Clinkers, Clunkers, and Lemons

There isn’t a fleet manager alive who hasn’t been frustrated by the cost of vehicle breakdowns. Although calculating per mile costs, along with the costs of oil, tires, and regular maintenance is easy, it’s those unexpected repairs and the expense required to put a vehicle back into service that throw a very big wrench into a department’s budget.

The National Institute of Justice (NIJ), in conjunction with its Office of Law Enforcement Standards (OLES) at the National Institute of Standards and Technology (NIST), is working on computer software to help fleet managers avoid these unwelcome surprises and to help them with vehicle disposal decisions. Dubbed AutoRank, this software program will help determine when a vehicle is due for replacement by its specific make, model, and year, thereby giving the fleet manager the opportunity to dispose of it before it causes problems.

“Fleet managers don’t know when the transmission is going to break down or when they’re going to have to do a ring job,” says Stephen Weber, principal investigator on the AutoRank project. “But it is just those mini-catastrophic failures that we’re trying to anticipate.”

According to Weber, a long-time NIST economist and developer of AutoBid, a widely used police vehicle selection software, AutoRank will classify and analyze vehicle failure data. Weber says that he is currently collecting data from agencies with fleets of at least 200 vehicles. He says that by studying the subsystems and major components in each vehicle model, and collecting data on the points when each of these subsystems or components fail, AutoRank will be able to estimate with relative accuracy when a specific model is likely to have problems.

“We will pick out the most significant failures, the ones that represent a $200 hit and that have some likelihood of occurrence in the coming year,” Weber says. “The fleet manager will take general information about the car, add some information about the most recent work on it, along with data on the most recent replacement or repair of any of the 16 to 20 subsystems we specify in the program. AutoRank will compute all of the information and produce a list, ranked by priority, of the vehicles most appropriate for disposal. These may not necessarily be the oldest ones. But they will be the ones that are going to cost the most in the coming year,” he says.

To better publicize the AutoRank project and to garner participation from law enforcement fleet managers, Weber attended the annual meeting of the Law Enforcement Group of the National Association of Fleet Administrators, where he gave a presentation to the 250 law enforcement members in attendance. “Their response was very positive,” he says.

Weber is still looking for participants to contribute to the data pool. He would like to hear from those who manage fleets of at least 200 vehicles of a particular model and year, 2 or more years old. Participants, he says, should be able to supply the following data:

- For each vehicle class: Manufacturer, model, year, depreciation rate, cost per mile, and cost per month.
- For each vehicle: VIN (Vehicle Identification Number), primary use (urban, suburban, highway), date put in service, current mileage, and purchase price.
- For each failure category: Failure description and repair description.

For each failure: Date of failure, cause of failure, mileage at time of failure, date of repair, mileage at time of repair, labor hours, and materials cost.

“We are collecting and analyzing failure data on cars that have been out there in the field, so the summary data included in AutoRank readily applies to today’s fleets,” Weber says. “Fleet managers will simply add the particulars about when their own vehicles have been repaired. AutoRank will give them a list of vehicles ready for disposal based on expected repair costs, operation and maintenance costs, and the loss of resale values. We expect AutoRank to produce a significant cost savings for law enforcement agencies.”

For more information about AutoRank or to contribute to the data pool, contact Stephen Weber at the National Institute of Standards and Technology, 301-975-6137, or e-mail him at sweber@nist.gov. The police vehicle selection software program AutoBid can be accessed through J USTNET, the World Wide Web site of the National Law Enforcement and Corrections Technology Center system, at www.nlectc.org.
Catch of the Day

Although the National Institute of Justice (NIJ) continues to study, evaluate, and develop vehicle-stopping technologies, it is not the only entity working on the vehicle-stopping problem. The U.S. Department of Defense's (DoD's) Joint Non-Lethal Weapons Directorate (JNLWD) also is performing a similar function. This DoD program office integrates the concerns and efforts of various military activities regarding vehicle stopping as well as non-lethal weapons development.

One JNLWD project involves the stopping of fleeing vehicles with a giant net that gradually drags the targeted vehicle to a halt. This concept is similar to that used to bring high-performance aircraft to a halt on aircraft carriers. The net is being developed for the JNLWD by Primex Technologies, in conjunction with the U.S. Army's Armament Research, Development, and Engineering Center (ARDEC), in Dover, New Jersey.

The net's operating principle is simple: two anchors are embedded into the ground on either side of a roadway. A net is placed inside a trough that extends across the width of the roadway. The trough looks like a small speed bump. One brake box is attached to each anchor. Each end of the net is connected by a cable to a brake box. To stop a targeted vehicle, an officer simply pushes a button to activate the net's deployment. The net pops out of the trough and extends across the roadway in the path of the targeted vehicle. The vehicle extends the net and pulls the cables that are attached to each brake box. Then, like the cable on an aircraft carrier, the brake box exerts enough force to slow the vehicle to a stop. The net wraps around the vehicle, preventing anyone inside from escaping.

"Our criteria was that we couldn't decelerate a car at more than 2G's, which is about double what a panic stop in your car would be," notes Primex Technologies' Randy Hoskins, the director of advanced development for solid propellant systems. "The speed at which you stop depends on how much the vehicle weighs and how fast you're going. The box is designed so that the farther you pull the line out, the harder it pulls on you, and the more brake force it adds." Primex demonstrated a prototype of the Car Catcher in 1997. Those tests included running a pickup truck into the net 25 times over a range of velocities and in differing conditions (weight added to the truck, net configurations). Although the net worked every time, the damage to the truck was obvious after about four stops. "The first time the truck looked okay," Hoskins says. "The second time it was okay. But after the fourth stop, we had a hard time opening the door because the fenders were shoved back a little bit. The sheet metal deformed slightly; it's obviously not meant to stop the same vehicle over and over again."

The Car Catcher, however, does require set-up time. In an area with sparse vegetation (notably, trees), officers may need to dig holes in the ground to anchor the device, something that takes about 2 hours. But it can also be anchored to existing trees, telephone poles, or other fixed objects, which reduces the set-up time to about 20 minutes.

Lt. Bob Osborne, of the Los Angeles County Sheriff's Department, is a member of NIJ's Pursuit Management Task Force (PMTF). PMTF is conducting an in-depth study of pursuits and available technologies. Osborne attended the Car Catcher demonstration. "It has some great features," Osborne says. "I liked the way the net seemed to envelop the car to prevent flight. We literally had to undo the car from the net to get the doors open. I also liked the way it was set up. It spanned two lanes, so you would have to go off-road to avoid it. It also looked like it deployed in about 1 to 1.5 seconds. That's pretty fast. If you're driving at any speed, it's not enough time to take any kind of evasive action," he says.

Ray Downs, Ph.D., Deputy Director of NIJ's Research and Technology Development Division and manager of NIJ's Less-Than-Lethal Weapons program, also was enthusiastic about the Car Catcher. "I liked it because it's solid science. It looks like a technology that can really stop a vehicle," Downs says. However, the Car Catcher may not be an appropriate device for general law enforcement purposes.

Its set-up time, even at 20 minutes, is too long, especially when statistics have shown that most pursuits are over in 6 minutes. It leaves a trail of rope, net, and cables on the road, which would require that police stop all traffic traveling behind the suspect vehicle. In a heavily traveled area, it could also be difficult to target the right car. Untangling the vehicle from the net also takes some time—about 15 minutes—and requires that officers push the car backward to create slack in the net. On the plus side, however, its one-button operation makes it easy to use, and it takes almost no special skill or knowledge to set it up or repackage it for reuse.

According to Hoskins, the Car Catcher is perfect for the military. It may become part of the security hierarchy at temporary military facilities and can be used to control traffic in countries where warring factions are a danger to the military and the local citizens. "We believe it also has an application at border crossings," Hoskins says. "There is always a problem with port-of-entry runners and with people trying to drive through border checkpoints. Since it is portable, it could be set up in places where you expect to have problems. It can also be permanently installed," he adds.

The Car Catcher could also be used against terrorist threats, Downs says, in cases where there is concern that vehicles loaded with explosives may be used for suicide missions. "You don't want the vehicle to crash, and you don't want to use gunfire to stop it. In situations like that, where lethal force might be appropriate but where it would be a mistake, this kind of device would work," he says.

Primex currently is making the Car Catcher more user-friendly. At the Army's request, Primex will make it easier to use, lighter, and more weatherproof.

For more information about the Car Catcher, or as the Army has named it, the Pre-Emplaced Vehicle Immobilizer, contact Randy Hoskins at Primex Technologies, 425-882-5772, or David Millette, the Army's program manager for the project, 973-724-6246.

Sign Up To Receive Free Reports From the National Criminal Justice Reference Service

In addition to funding the National Law Enforcement and Corrections Technology Center, NIJ also supports the National Criminal Justice Reference Service (NCJRS), an international clearinghouse on crime and justice information. NCJRS staff respond to reference questions, provide referrals to other resources, distribute NIJ and other Office of Justice Programs (OJP) documents, and maintain a mailing list of over 45,000 registered users. If you are interested in signing up for the NCJRS mailing list, you may request a registration form using any of the following methods:

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Ohio Inmates Get ‘Carded’

The Ohio Department of Rehabilitation and Correction (ODRC) is helping lead the way toward a revolution in inmate information management with a pilot project that has prisoners using “smart cards.”

According to Peggy Ritchie-Matsumoto, Deputy Director of ODRC’s Office of Management Information Systems and a systems strategist, this project, funded by the National Institute of Justice (NIJ), marries computer chips with photo identification cards. Initially the cards will be used to track the medication activity of 2,300 inmates in a medium-security men’s facility.

“It’s like a driver’s license with a computer chip in it,” Ritchie-Matsumoto says. “The inmate’s photo is electronically stored, as is the data that says who he is and what his inmate number is. When an inmate comes up to the pharmacy, he puts the card into a reader that scans the information on the microchip contained in the card. If I’m the pharmacist, what I see on my computer screen is the inmate’s pharmacy record. I know what he requested is and what medication he is to have. I’ll also know if he has refused meds before, or if he has not picked up his meds. This system will track all of that,” she says.

According to Ritchie-Matsumoto, a processor and memory chip are embedded in the card, and they have the capacity for offline storage as well as encryption for security. Benefits of the system include an increased ability to manage inmate data and a faster process for dispensing medication. ODRC currently spends 1 minute per patient dispensing medication. The smart card is expected to significantly reduce the time required to complete this paper-intensive process from 1 minute to a few seconds.

The smart card project relies on software created by the Battelle Institute, a nonprofit company that works with national security, health, environmental, transportation, and industrial technologies. Battelle has been involved with smart card technologies since 1980. The company helped the U.S. Department of Defense develop electronic dog tags for soldiers in Desert Storm and create a smart card for colleges/universities that deducts purchases from student accounts.

Smart cards can involve several different types of technologies and can be issued for a variety of purposes. Some provide access to restricted areas and some are service related, like telephone calling cards or those that deduct purchases from a holder’s account. Some can be used for identification purposes only, while others enable remote payment, money access, and information exchange via computer, telephone, or television “set-top boxes.” Biometric information, such as fingerprints, eye scans, or “finger geometry,” which takes measurements of the finger and converts it to a three-dimensional model for matching, can all be used to verify the card user’s identity.

Smart cards are especially popular in Europe, where many automatic teller machines require a thumbprint for identification. In Australia, where there is a national debit card system and where noncash payments are growing at about 50 percent each year, smart cards are proliferating rapidly. But to date, the cards have not been as well received in the United States. When Utah legislators in 1997 talked about implementing a smart card driver’s license, one of the biggest concerns was about the privacy of the data. When New Jersey began considering a smart card driver’s license that would include a fingerprint of the driver, the American Civil Liberties Union protested, and the idea eventually was scrapped.

“Privacy issues also figure prominently in discussions about using smart cards for health care,” Ritchie-Matsumoto says. “I just don’t think the public is ready for a smart card where you walk into a doctor’s office and have your whole medical history come up onscreen.”

“There is a lot of resistance to smart cards in the general population, which is why part of the research is happening in closed environments like prisons, universities, and in the medical arena,” she says. “The public in this country doesn’t seem quite ready to have smart cards, but it is definitely where we’re going. Pretty soon our computer keyboards will have biometrics built right into them. Even now there is a user identification device that can be plugged into the keyboard.”

Although smart card technology is still in its infancy in the United States—Americans bought only 2 percent of the 826 million cards sold worldwide in 1996—it is a technology that is gaining popularity. A 1997 conference sponsored by the Smart Card Industry Association boasted 530 exhibitors and 7,500 attendees from 65 countries. Total card sales in the United States are expected to increase as well, rising from 2 percent in 1996 to 15 percent of total world-wide sales by 2000.

According to Ritchie-Matsumoto, the ODRC smart card project is not just addressing the technical aspects of this technology. Attendant issues also are being considered, such as the legality and acceptability of an electronic signature and the problem of authenticating a pharmacist’s signature. The ODRC is working with the Ohio State Pharmacy Board on a workable solution. Another issue being addressed, she says, concerns inmate reaction to the cards.

“It’s difficult to predict: Will they destroy their cards? Will they try to exchange their cards? Will they try to carve the chip out of the cards? If this project is successful and the card becomes so totally integrated that the inmates need it for meals, access to certain areas, or to the commissary, my guess is that they won’t do anything to damage it,” Ritchie-Matsumoto says.

In the early stages, Ritchie-Matsumoto says, the smart cards will be integrated with the ODRC’s electronic photo-imaging system, so that when the card is used, it will automatically bring up a picture of the inmate on a computer screen. In the future, however, plans are to activate magnetic strips, bar coding, and some form of biometric identification. The vision is for a multisize card that pertains to many aspects of prison life. Inmate classification, medical and mental health information, education status, and parole information will be stored on the microchip.

For more information on the project, contact Peggy Ritchie-Matsumoto at the Ohio Department of Rehabilitation and Correction, 614-752-1262, or Steve Morrison, program manager, National Law Enforcement and Corrections Technology Center-Southeast, 800-292-4385.
Product Evaluations: DKL LifeGuard and Myotron “Checkmate”

From time to time, the National Institute of Justice’s (NIJ’s) Office of Science and Technology or its satellite facilities are requested to conduct product testing to determine if a manufacturer’s claims are accurate or to determine if the product/technology is applicable for law enforcement, corrections, or forensics use. If a request is deemed appropriate by NIJ, the product is tested by independent laboratories. In these two situations, Sandia National Laboratories conducted tests pursuant to agreements with NIJ. The findings are made available to the criminal justice community. The following summaries represent the results of two such evaluations, one regarding the DKL LifeGuard human presence detector and the other the Myotron “Checkmate” Pulse Weapon.

DKL LifeGuard

At the request of the U.S. Department of Energy, Sandia National Laboratories recently conducted an evaluation of the LifeGuard Model 2, a device manufactured by DielectroKinetic Laboratories, LLC (DKL) and marketed as a human presence detector and tracker. In its evaluation report, titled Double-Blind Evaluation of the DKL LifeGuard Model 2, Sandia concluded that “the results were that the device [LifeGuard Model 2] failed to meet its published specifications and its performance was no better than random chance.”

As part of the evaluation, a DKL representative operated the device, attempting to determine the location of a “test target” (human individual) who was randomly hidden within one of five shipping containers. This evaluation was double-blind, with neither the DKL representative nor the Sandia investigators aware of which container the test target was hidden in until after the exercise. Twenty-five trials were performed during the double-blind portion of the evaluation with the DKL representative successfully selecting the correct container 6 out of 25 trials. According to the Sandia report, this is equivalent to guessing, as “the operator had a one-in-five probability of success by chance alone.”

Additional information about the evaluation of the DKL LifeGuard Model 2 can be found on the World Wide Web at www.sandia.gov/media/hudet.html or by contacting Thomas Coty of the National Institute of Justice at 202-514-7683 or at cotyt@ojp.usdoj.gov. The results of this Department of Energy-sponsored test are provided for informational purposes and do not necessarily reflect the views of the National Institute of Justice.

Myotron “Checkmate”

The Myotron “Checkmate” Pulse Weapon, manufactured by Arianne International and marketed as a less-than-lethal personal protection device, was recently evaluated by Sandia National Laboratories to determine the accuracy of manufacturer claims. There are several discrepancies between the manufacturer’s claims and the test results.

- The manufacturer states that the Myotron “Checkmate” is more than 10 times as powerful as the average stun gun. Although testing of a purchased model revealed that the product has one of the highest electrical outputs for stun guns, it is not more than 10 times the power of the “average” stun gun.

- The manufacturer claims that the device can deliver more than 10,000 bursts from the powerpack, but testing indicates that 4,000 bursts are more likely.

- The manufacturer reports that the device “intercepts and neutralizes brain waves from the motor cortex (voluntary muscle control) and hypothalamic (aggression) regions of the brain,” which produces no side effects. Although neither animal nor human subject testing was conducted, testing did consist of an electrical engineering evaluation, a general evaluation by industrial hygiene/toxicology personnel, and an overall high-level systems analysis by Sandia National Laboratories. Results indicate no evidence to support this claim.

If you would like more information regarding the Myotron “Checkmate” Pulse Weapon test results, contact James Williams, NIJ Program Manager, at 202-305-9078 or at williamj@ojp.usdoj.gov.