NATIONAL LAW ENFORCEMENT AND CORRECTIONS TECHNOLOGY CENTER
A program of the National Institute of Justice

From Summer 2001 *TechBeat*

TECH b•e•a•t

Dedicated to Reporting Developments in Technology for Law Enforcement, Corrections, and Forensic Sciences

Body Armor on Board

With more than 300 officers patrolling a 1,500-square-mile area, 80 percent of them on foot and bike, coupled with Washington, D.C.'s oppressively hot and humid summers, the police department of the Washington Metropolitan Area Transit Authority needed to find body armor that would give its officers an appropriate level of ballistic protection yet be lightweight and comfortable.

Metro Transit's body armor selection committee put more than a year into the search. Some of that time was spent in consultation with the National Law Enforcement and Corrections Technology Center (NLECTC)–National in nearby Rockville, Maryland, which operates the National Institute of Justice's (NIJ's) ballistic- and stab-resistant body armor testing and compliance program.

"I don't know how some of our guys stand it in the summer," says Officer Barry E. Housel, Metro Transit Tactics/Firearms Instructor and the point man for research on the selection committee. "We needed to find armor that used the latest technology yet was more wearable for field officers. We ended up stopping at NLECTC quite a bit for advice on how to proceed."

Housel estimates that he visited NLECTC three times and exchanged a number of e-mails. Another committee member, Officer Jeff Sesok, says he visited NLECTC seven times and lost count of the telephone calls he made. "NLECTC pretty much rolled out the red carpet for us," Housel says. "If they couldn't see us that day, they saw us the next business day. They also made sure we had plenty of copies of their *Selection and Application Guide to Police Body Armor*, which offered us a step-by-step plan to follow."

According to Housel, the selection committee, which included a member from each of the department's five field divisions, focused first on the level of protection the new armor would need to provide. Metro Transit's jurisdiction covers not only the District of Columbia but extends into a number of counties and cities in Maryland and Virginia. Sesok says the committee visited area police departments to ask about the firearms their officers were confiscating off the street. The committee also considered the firearms its own officers were seizing as well as those issued to them by their department.

Based on their findings, the committee selected Protection Level III–A. "We were kind of on the bubble between [Protection Level] II and III–A," Housel says. "We could have gone with the lower threat level of II, but we scoured the *Selection and Application Guide* frontwards and backwards. Our final determination was based on the information in the guide as well as our conversations with the body armor testing staff at NLECTC. They were able to answer our questions and concerns."

Sesok says that once the committee decided what threat protection level it needed, it addressed wearability issues. Because he spends most of his time on a bicycle, riding up to 15 to 20 miles a day, Sesok wanted to be sure his new vest would be comfortable. NLECTC staff provided the committee information and resources about the types of ballistic material on the market, he says. They also provided a list of the models of body armor that complied with NIJ's ballistic body armor standards.

Once the committee decided what type of ballistic material it preferred, it had to select a carrier—the removable, washable garment that contains the ballistic panels and holds them next to the torso.

"We wanted something that would mold to the officer's body better than our old ones did," Housel says. "We also received information from NLECTC regarding carriers, and we were amazed at the different types available. Committee members along with several other officers tested various types of armor for several months. We ran into a number of problems involving too-rigid armor and awkward fastenings. Female officers in particular had difficulty finding a good fit. But our aim from the get-go was to get our people a wearable fit without compromising ballistic integrity."

Sesok says the committee eventually met with a vendor who created a new model to Metro Transit's specifications. "We were told it was the talk of a trade show when the company first exhibited it," he says. "It has since passed NIJ compliance testing." Sesok points out, however, that in development of the new model, NIJ standards and NLECTC–National's reputation helped settle an issue regarding the overlap between the front and back

panels. "The *Selection and Application Guide to Police Body Armor* recommends a 2-inch overlap between the panels," Sesok says. "This company said they didn't do it. We had a meeting and pointed out the recommendation to them. They said, "'We'll do it.'"

As for the new armor, "The difference is just unbelievable," Sesok says. "With the old vests, on a hot summer day, you could almost feel the steam coming off your body when you took it off. It was like a sigh of relief. We're hoping that our new model will encourage more officers to wear their armor all the time."

Housel says NLECTC–National also made sure the selection committee knew about the Bulletproof Vest Partnership (BVP) Grant Act of 1998, which pays up to 50 percent of the cost of new NIJ-approved armor. Housel had read about the BVP on the Internet. To date, Metro Transit has received almost $100,000 in grant money.

"Our command staff, meaning the chief and deputy chiefs, let us do what we needed to do to get it done," Housel says. "We're very fortunate that NLECTC was this close. If I could say one thing to another department, it would be to utilize NIJ and NLECTC as much as possible. The handbook and the resources they have give you credibility when talking with armor vendors. This really should be a department's first stop."

"It really shows them that you're an informed consumer, like reading Consumer Reports before you buy a car," Sesok adds.

For information about body armor selection, call the National Law Enforcement and Corrections Technology Center, Rockville, Maryland, 800–248–2742.

Body Armor: Details Count

When law enforcement personnel come face to face with armed suspects, they do not think about the "details" of their body armor—the layers of material, the stitching, or how the label is worded. Their only concern is the ability of that armor to stop a bullet.

But day in and day out, a staff of body armor testing technicians at the National Institute of Justice's (NIJ's) National Law Enforcement and Corrections Technology Center (NLECTC)–National in Rockville, Maryland, pay close attention to the "details" of ballistic body armor. This attention to detail has helped save the lives of law enforcement officers.

"NLECTC–National has provided third-party oversight and management of NIJ's body armor testing program since the mid-1980s," says Lance Miller, Equipment Testing Program Manager. "Our testing program staff are mostly former law enforcement officers; one still is. That experience gives them an added awareness of the impact of what they do. The work isn't highly technical, but it is very detail oriented. You can't take what you do casually because it ultimately affects the safety of law enforcement officers all over the world. We oversee the testing of an average of 250 to 300 models of ballistic body armor every year."

To have its body armor tested, a manufacturer must contract with an NIJ-approved independent testing laboratory, Miller explains. The manufacturer schedules the tests and pays any associated fees. The manufacturer must send six armor samples to NLECTC–National approximately 2 weeks before the scheduled test date. When NLECTC–National receives the samples, testing staff examine all of them to see that they meet labeling and workmanship requirements before forwarding them to the testing laboratory for penetration and blunt trauma testing.

"We look for general, commonsense, visual things when the vests come in," says Alex Sundstrom, one of three full-time equipment testing technicians. "We check the seams and stitching to make sure they're secure and that nothing is hanging loose. If there are fastenings, we make sure they're on securely and that they do actually fasten. We make sure the ballistic panels fit properly into the carrier."

Even the labels on the armor are checked, Sundstrom says. Although NIJ standards specify what information needs to be on each model label and provide samples, the amount of detail the labels must have often presents the biggest challenge to manufacturers, especially those just starting with the program. "We encourage them to fax us labels ahead of time," he says, "so we can point out things that they will need to fix."

If the six armor samples meet the labeling and workmanship criteria, they are sent on to a testing laboratory. Four samples undergo penetration and blunt trauma impact testing. If these four samples pass, the fifth sample undergoes Baseline Ballistic Limit testing. The sixth is a reserve. Following these tests, the laboratory checks each piece of armor for inconsistencies in construction.

"All six sample vests must be made the same way," Sundstrom says. "The lab counts how many layers of each kind of bullet-resistant fabric make up the armor. They check the stitching to make sure all have the exact same pattern. And they use a commercial linen counter to check the thread count in the material's weave. This information is sent back to us in a report. Once we receive the samples and report back from the laboratory we not only make sure the laboratory placed the shots accurately, we also reverify all the construction information contained in the report. Any inconsistency, no matter how slight, may make a difference in how the armor performs in the field."

"Historically, about 50 percent of everything we test fails," Miller says. "The standard is pass/fail: if you fail, you fail. In addition, we do not rate the armor that passes as good, better, or best. What is 'best' varies according to each department's needs. There are a number of issues for agencies purchasing armor to consider, but we're an important first step in ensuring the armor they buy is safe and reliable."

As Miller points out, law enforcement agencies also face an ongoing issue about how well armor works after it has been in service for a period of time. That is why the Baseline Ballistic Limit test was added in October 2000. This test, he says, is based on the military V_{50} test, which determines the velocity at which a particular type of bullet will penetrate a given armor model 50 percent of the time. Several years later, if a department performs the same test on another sample of the same model, a result outside that limit will show that something has changed. The manufacturer may have used different materials, or the materials themselves may have degraded during use. Because the Baseline Ballistic Limit test was added just last year, law enforcement agencies have not yet used its results.

Miller says almost 3,000 armor models have undergone NIJ compliance testing since 1987. NLECTC–National permanently archives the samples in a secure offsite facility. The archived armor has proven its value on several occasions. "Law enforcement agencies have come to us because they did their own testing on vests and want to compare them with the vest we tested, or they purchased vests as part of a major procurement and they want to be sure what they bought is the same as what we tested," he says. "We have found differences on some occasions. The agencies then go back to the manufacturer and work things out."

"In some cases," he says, "NIJ has revoked the compliance status of models based on our findings of inconsistent construction if the manufacturer would not or could not provide an acceptable explanation of why the construction details were changed."

Testing staff can also go into the archive if they suspect a manufacturer is resubmitting a vest that failed under a different model designation. "When a vest fails, the manufacturer loses that particular model designation forever. They will change whatever they think needs to be changed in regards to the construction of the vest, and send it back, but it will have a new model number," Miller says. "We're not in the business of telling manufacturers how to make vests. We don't endorse any particular material or type of construction. We leave that up to the industry, and they're always looking for ways to improve."

One way for agencies to keep up with ballistic armor models that have passed compliance testing is the *Consumer Product List for Police Body Armor*. Until several years ago, laboratories prepared their reports in proprietary software and gave NLECTC–National paper copies. "We kept manual records, and it was an absolute nightmare to try to do any kind of research or analysis about the testing program," Miller says. "But in the mid-1990s, we developed an electronic database of testing results. We used to publish the *Consumer Product List* in hardcopy. The problem was, by the time we sent it to the printer, it was outdated. It wasn't giving law enforcement agencies timely, accurate information. Now, as we add new models to the list, we hit the switch and they're in the database. This database is available through the NLECTC system website at www.nlectc.org 24 hours a day. In addition, we provide a weekly download to the U.S. Department of Justice's Bulletproof Vest Partnership (BVP) Grant program to keep the BVP database current as well."

Soon, Miller says, laboratory staff will be able to use a new reporting tool to enter and upload information directly into the database. This will help save time and reduce errors caused by rekeying from paper copies.

Although revised standards and new technologies have created changes, Miller says the biggest impact on the testing program has been the growing number of armor manufacturers. "The number of manufacturers has increased exponentially, to almost 100," he says, "and many of those new manufacturers are located outside the United States. We've tested armor from almost every continent in the world."

In fact, according to Miller, almost 50 percent of manufacturers currently sending armor for testing are from outside the United States. Why? Because a growing number of foreign law enforcement agencies also require NIJ compliance of their armor. Also, with the recently revised NIJ standards, NLECTC has seen a large increase in the amount of armor sent for testing in the past 6 months.

"But no matter where the armor comes from, it goes through the same process and receives the same careful attention every step of the way," he says. "We have a system in place to track where a piece of armor is at all times. We can tell a manufacturer with 100-percent accuracy where a particular model vest is at any point in time. It is just one more aspect of that ongoing attention to detail."

"There are more than 17,000 law enforcement agencies in the United States," Miller adds. "Many of them are small and don't have the resources to test the equipment they buy. Through our testing program, we can help them make informed decisions about body armor. And of course, the best part of the service for them is that it's free.

"In 20-plus years of testing, NIJ-approved armor has never failed to meet its intended level of protection in the field. We're very proud of that. It's ultimately what we hang our hat on, and what instills confidence in our program by law enforcement agencies."

For more information about ballistic body armor standards and testing, contact Alex Sundstrom at the National Law Enforcement and Corrections Technology Center in Rockville, Maryland, 800–248–2742. To obtain a copy of the* Selection and Application Guide to Personal Body Armor *or* NIJ Standard–0101.04, Ballistic Resistance of Personal Body Armor, *log on to www.nlectc.org.

You Just Can't Throw It Away

The Bulletproof Vest Partnership (BVP) Grant Act of 1998 has helped many law enforcement agencies buy the ballistic-resistant armor they need. In some cases, a department already has serviceable armor but needs a different type, perhaps because the threat level in its jurisdiction has increased. This can create a dilemma: What to do with the old armor?

"Most of the materials used to make body armor don't degrade, so you can't put the vests in a landfill," says Lance Miller, Equipment Testing Program Manager for the National Law Enforcement and Corrections Technology Center (NLECTC)–National. "They're also cut resistant, so you can't take a pair of heavy-duty shears and slice them up. They're flame resistant, so you can't burn them. And you don't want them anywhere that the general public can get their hands on them."

At one time, Miller says, departments were encouraged to give their armor to smaller law enforcement agencies that could not afford to buy their own. Thanks to the BVP grant, however, it has become harder to find small jurisdictions that need donations. Under this act, law enforcement agencies can apply online to buy armor, and the Bureau of Justice Assistance will match up to 50 percent of costs, including shipping and taxes. More than half of the agencies that have taken advantage of this program serve areas with populations of less than 100,000.

Law enforcement agencies looking to dispose of old armor have several options. Although departments may not have the tools to cut up armor, Miller says, some manufacturers have equipment that chops it into small pieces that are recycled into other materials. Agencies should contact their armor manufacturers to find out if this is an option.

Agencies might consider using the armor to provide extra protection inside the door panels of cruisers or behind desks and partitions in work areas, or as backstop material at indoor firing ranges. If an agency places armor in any of these areas, it should remove any trauma packs or hard armor inserts. The agency should remove the armor from cars or other equipment before selling or discarding the equipment.

If the old armor is still serviceable, Miller suggests that agencies use it in their training academies. "A department may want to issue the old armor to its recruits and make them wear it. This will get them used to wearing vests on a daily basis. If they get used to it in training, they'll wear it later. The armor can be passed from class to class as new officers are issued their own armor."

NLECTC–National is now exploring taking donations of used ballistic body armor. Miller says that if the law enforcement agency can document how the armor was used—not only the purchase date but whether it was worn daily by a patrol officer, occasionally by a detective, or kept in storage—NLECTC might be interested in using it for research. Details regarding this program will be forthcoming.

For more information about the disposal of body armor, contact Lance Miller at the National Law Enforcement and Corrections Technology Center in Rockville, Maryland, 800–248–2742. For more information about the Bulletproof Vest Partnership Act, log on to http://vests.ojp.gov or call the U.S. Department of Justice Response Center at 800–421–6770.

Testing, Testing

The ballistic-resistant body armor testing program operated by the National Institute of Justice's (NIJ's) National Law Enforcement and Corrections Technology Center (NLECTC)–National is its most extensive and well-known testing program, but it is not the only one. NLECTC also administers seven other law enforcement equipment testing programs. These testing programs fall into two groups: standards-based testing and comparative evaluation or field testing.

In standards-based testing, equipment is tested on a pass/fail basis against standards developed by the Office of Law Enforcement Standards. Equipment that passes is listed as complying with NIJ standards. Manufacturers submit their equipment for voluntary testing and have some input into standards development. Standards-based testing programs cover:

- Ballistic-resistant body armor.
- Stab-resistant body armor.
- Double-locking metallic handcuffs.
- Semiautomatic pistols.

Equipment that passes standards-based testing is published in the appropriate consumer product list (CPL). All CPLs are available through the NLECTC website at www.nlectc.org. Semiautomatic pistol information is available in print form by calling 800–248–2742.

The second category of testing is comparative evaluation, in which equipment is tested under field conditions and the results published. This allows law enforcement agencies to select equipment that best suits their needs. For example, some tires perform better on wet roads, while others do better on dry roads. A law enforcement agency in Seattle might choose a different tire for their cruisers than one in Phoenix. Comparative evaluations are conducted on:

- Patrol vehicles.
- Patrol vehicle tires.
- Replacement brake pads.
- Cut-, puncture-, and pathogen- resistant protective gloves.

Complete results of these tests are published in a series of equipment performance reports, available on the NLECTC system website at www.nlectc.org. Printed copies may be obtained by calling NLECTC–National, 800–248–2742.

This article was reprinted from the Summer 2001 edition of *TechBeat,* the award-winning quarterly newsmagazine of the National Law Enforcement and Corrections Technology Center system, a program of the National Institute of Justice under Cooperative Agreement #96–MU–MU–K011, awarded by the U.S. Department of Justice.