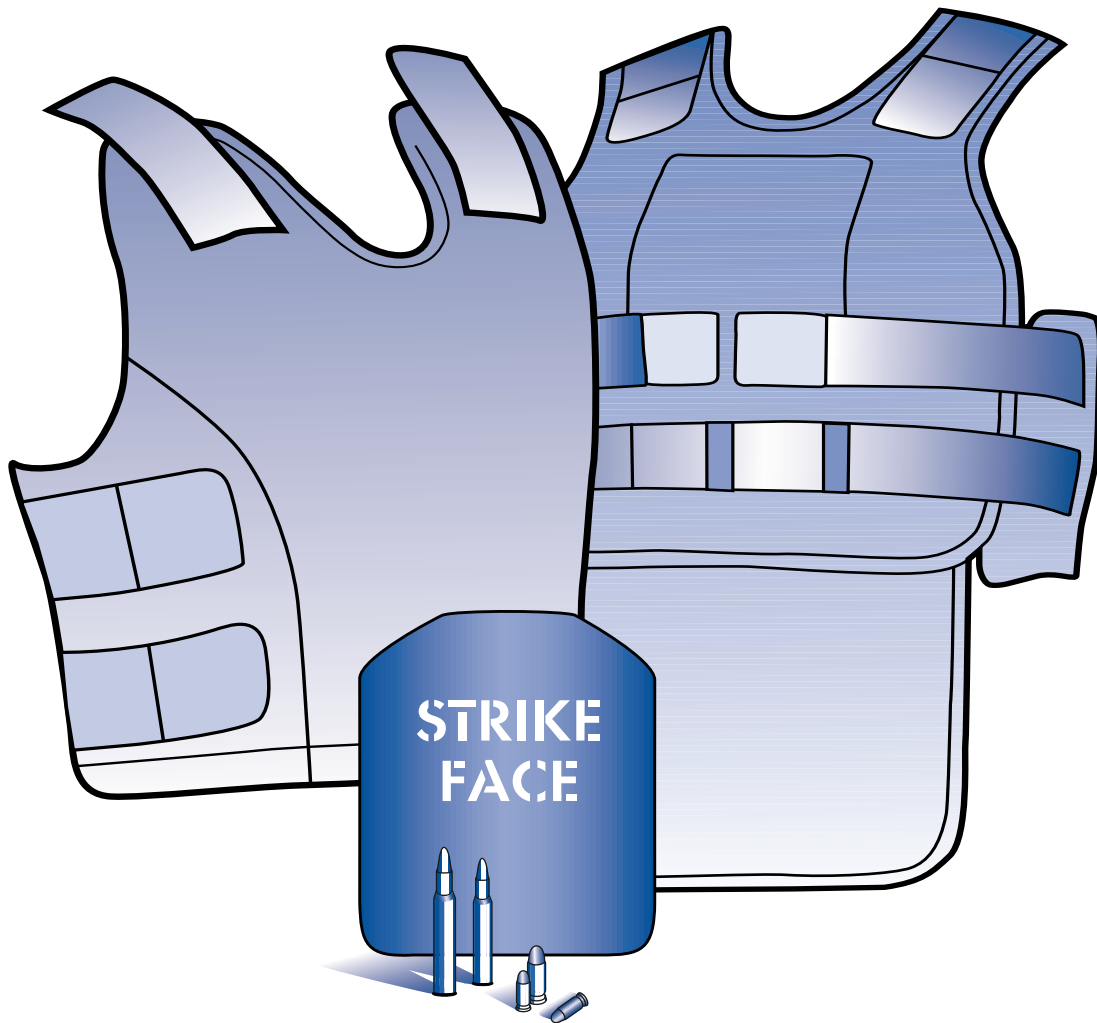




Selection and Application Guide to Police Body Armor

NIJ Guide 100-98



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Selection and Application Guide to Police Body Armor

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Foreword

The National Law Enforcement and Corrections Technology Center (NLECTC) is pleased to present this updated version of the *Selection and Application Guide to Police Body Armor*, the first revision since 1989. Recognizing the significant advances in ballistic protection materials and body armor design technology since the last version was published, we believe this guide will serve as an invaluable tool for law enforcement administrators and procurement officials responsible for body armor selection and purchasing. We also strongly encourage trainers and all officers who are issued body armor to review this guide. The guide will enhance their understanding of the benefits of the routine use of body armor, as well as dispel some common myths and misconceptions regarding body armor selection and use.

Many individuals were integral to the development of this guide, either through their direct efforts or by providing information about their organizations. We would like to take this opportunity to recognize them:

Foremost, a note of appreciation goes to **Mr. Lester D. Shubin**, formerly Program Manager for Standards of the National Institute of Justice, **Mr. Lawrence K. Eliason**, formerly the Chief of the Law Enforcement Standards Laboratory (LESL, now known as the Office of Law Enforcement Standards, or OLES), and to **Mr. Daniel E. Frank**, formerly Manager of the Protective Equipment Program of the Office of Law Enforcement Standards at the National Institute of Standards and Technology. These men were responsible for preparing the original version of this document, first published in 1987 and revised in 1989.

We would also like to thank the following individuals and organizations who provided information that helped to develop this publication:

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About the National Institute of Justice

The National Institute of Justice (NIJ), a component of the Office of Justice Programs, is the research agency of the U.S. Department of Justice. Created by the Omnibus Crime Control and Safe Streets Act of 1968, as amended, NIJ is authorized to support research, evaluation, and demonstration programs, development of technology, and both national and international information dissemination. Specific mandates of the Act direct NIJ to:

- Sponsor special projects and research and development programs that will improve and strengthen the criminal justice system and reduce or prevent crime.
- Conduct national demonstration projects that employ innovative or promising approaches for improving criminal justice.
- Develop new technologies to fight crime and improve criminal justice.
- Evaluate the effectiveness of criminal justice programs and identify programs that promise to be successful if continued or repeated.
- Recommend actions that can be taken by Federal, State, and local governments as well as by private organizations to improve criminal justice.
- Carry out research on criminal behavior.
- Develop new methods of crime prevention and reduction of crime and delinquency.

In recent years, NIJ has greatly expanded its initiatives, the result of the Violent Crime Control and Law Enforcement Act of 1994 (the Crime Act), partnerships with other Federal agencies and private foundations, advances in technology, and a new international focus. Some examples of these new initiatives:

- New research and evaluation is exploring key issues in community policing, violence against women, sentencing reforms, and specialized courts such as drug courts.
- Dual-use technologies are being developed to support national defense and local law enforcement needs.
- Four regional National Law Enforcement and Corrections Technology Centers (NLECTC), a Border Research and Technology Center, and three special offices have joined the National Center in Rockville, Maryland, to form the NLECTC system.
- The causes, treatment, and prevention of violence against women and violence within the family are being investigated in cooperation with several agencies of the U.S. Department of Health and Human Services.

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- NIJ's links with the international community are being strengthened through membership in the United Nations network of criminological institutes; participation in developing the U.N. Criminal Justice Information Network; initiation of UNOJUST (U.N. Online Justice Clearinghouse), which electronically links the institutes to the U.N. network; and establishment of an NIJ International Center.
- The NIJ-administered criminal justice information clearinghouse, the world's largest, has improved its online capability.
- The Institute's Drug Use Forecasting (DUF) program has been expanded and enhanced. Renamed ADAM (Arrestee Drug Abuse Monitoring), the program will increase the number of drug-testing sites, and its role as a "platform" for studying drug-related crime will grow.
- NIJ's new Crime Mapping Research Center will provide training in computer mapping technology, collect and archive geocoded crime data, and develop analytic software.
- The Institute's program of intramural research has been expanded and enhanced.

The Institute Director, who is appointed by the President and confirmed by the Senate, establishes the Institute's objectives, guided by the priorities of the Office of Justice Programs, the Department of Justice, and the needs of the criminal justice field. The Institute actively solicits the views of criminal justice professionals and researchers in the continuing search for answers that inform public policymaking in crime and justice.

About the Law Enforcement and Corrections Standards and Testing Program

The Law Enforcement and Corrections Standards and Testing Program is sponsored by the Office of Science and Technology of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which directed NIJ to encourage research and development to improve the criminal justice system and to disseminate the results to Federal, State, and local agencies.

The Law Enforcement and Corrections Standards and Testing Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationwide and internationally.

The program operates through the following:

- The **Law Enforcement and Corrections Technology Advisory Council (LECTAC)**, consisting of nationally recognized criminal justice practitioners from Federal, State, and local agencies, assesses technological needs and sets priorities for research programs and items to be evaluated and tested.
- The **Office of Law Enforcement Standards (OLES)** at the National Institute of Standards and Technology develops voluntary national performance standards for compliance testing to ensure that individual items of equipment are suitable for use by criminal justice agencies. The equipment standards developed by OLES are based upon laboratory evaluation of commercially available products in order to devise precise test methods that can be universally applied by any qualified testing laboratory and to establish minimum performance requirements for each attribute of a piece of equipment that is essential to how it functions. OLES-developed standards can serve as design criteria for manufacturers or as the basis for equipment evaluation. The application of the standards, which are highly technical in nature, is augmented through the publication of equipment performance reports and user guides. Individual jurisdictions may use the standards in their own laboratories to test equipment, have equipment tested on their behalf using the standards, or cite the standards in procurement specifications.
- The **National Law Enforcement and Corrections Technology Center (NLECTC)**, operated by a grantee, supervises a national compliance testing program conducted by independent laboratories. The standards developed by OLES serve as performance benchmarks against which commercial equipment is measured. The facilities, personnel, and testing capabilities of the independent laboratories are evaluated by OLES prior to testing each item of equipment. In addition, OLES helps NLECTC staff review and analyze data. Test results are published in consumer product reports designed to help justice system procurement officials make informed purchasing decisions.

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Publications are available at no charge through the National Law Enforcement and Corrections Technology Center. Some documents are also available online through the Justice Technology Information Network (JUSTNET), the center's Internet/World Wide Web site. To request a document or additional information, call 800-248-2742 or 301-519-5060, or write:

National Law Enforcement and Corrections Technology Center

P.O. Box 1160

Rockville, MD 20849-1160

E-mail: *asknlectc@nlectc.org*

World Wide Web address: *http://www.nlectc.org*

About the National Law Enforcement and Corrections Technology Center System

The National Institute of Justice (NIJ), responding to recommendations from 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, which encompasses the national center, four regional centers, the Border Research and Technology Center, the Office of Law Enforcement Standards (OLES), the Office of Law Enforcement Technology Commercialization (OLETC), and the National Center for Forensic Science.

These facilities are part of a law enforcement and corrections information network that will make it easier for agencies and organizations to locate new products and for industry to identify law enforcement and corrections requirements.

NLECTC's major responsibilities and goals are to:

- Work with OLES to establish voluntary standards for selected law enforcement equipment and to manage voluntary compliance testing programs.
- Develop critical product databases for law enforcement and corrections that include such information as who manufactures what, who the points of contact are, what testing or evaluation information is available, and what other law enforcement agencies use the product and can discuss its effectiveness.
- Assist law enforcement in understanding what technologies are available, how they can be used, and what advantages they offer.
- Evaluate products such as body armor, firearms, vehicle tires, and handcuffs.
- Conduct field demonstrations of new law enforcement and corrections technologies.
- Collect law enforcement and corrections needs and requirements information for use by industry in developing affordable technologies for law enforcement and corrections.
- Disseminate information about its resources and services through newsletters, product bulletins, consumer product lists, articles in criminal justice periodicals, exhibits and presentations at criminal justice conferences, and online access.
- Coordinate the Law Enforcement and Corrections Technology Advisory Council (LECTAC), which is composed of nationally recognized criminal justice professionals from Federal, State, and local law enforcement and corrections agencies. LECTAC helps NIJ set priorities for developing new equipment standards, testing available products, and establishing future program initiatives for NLECTC.

SELECTION AND APPLICATION GUIDE TO POLICE BODY ARMOR

To receive more information or to add your name to the NLECTC mailing list, call 800-248-2742 or 301-519-5060, or write:

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The following is a list of NLECTC regional and affiliated facilities that assist NIJ in fulfilling its mission.

NLECTC-Northeast

26 Electronic Parkway

Rome, NY 13441-4514

(p) 888-338-0584

(f) 315-330-4315

E-mail: nlectc_ne@rl.af.mil

NLECTC-Southeast

7325 Peppermill Parkway

North Charleston, SC 29418

(p) 800-292-4385

(f) 803-207-7776

E-mail: nlectc-se@nlectc-se.org

NLECTC-Rocky Mountain

2050 East Iliff Avenue

Denver, CO 80208

(p) 800-416-8086

(f) 303-871-2500

E-mail: nlectc@du.edu

NLECTC-West

c/o The Aerospace Corporation

2350 East El Segundo Boulevard

El Segundo, CA 90245-4691

(p) 888-548-1618

(f) 310-336-2227

E-mail: nlectc@law-west.org

Border Research and Technology Center

225 Broadway

Suite 740

San Diego, CA 92101-5005

(p) 619-232-1276 or 888-656-2782

(f) 619-232-1451 or 888-660-2782

E-mail: brtcchrisa@aol.com

Office of Law Enforcement Technology Commercialization

316 Washington Avenue

Wheeling, WV 26003

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(f) 304-243-2131

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Office of Law Enforcement Standards National Institute of Standards and Technology

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National Center for Forensic Science

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Orlando, FL 32816-2367

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About the Office of Law Enforcement Standards

The Office of Law Enforcement Standards (OLES) was established as a matrix management organization in 1971 through a Memorandum of Understanding between the Departments of Justice and Commerce based upon the recommendations of the President's Commission on Crime. OLES' mission is to apply science and technology to the needs of the criminal justice community, including law enforcement, corrections, forensic science, and the fire service. While its major objective is to develop minimum performance standards, which are promulgated as voluntary national standards, OLES also undertakes studies leading to the publication of technical reports and user guides.

The areas of research investigated by OLES include clothing, communication systems, emergency equipment, investigative aids, protective equipment, security systems, vehicles, weapons, and analytical techniques and standard reference materials used by the forensic science community. The composition of OLES' projects varies, depending upon priorities of the criminal justice community at any given time and, as necessary, draws upon the resources of the National Institute of Standards and Technology.

OLES assists law enforcement and criminal justice agencies in acquiring, on a cost-effective basis, the high-quality resources they need to do their jobs. To accomplish this, OLES:

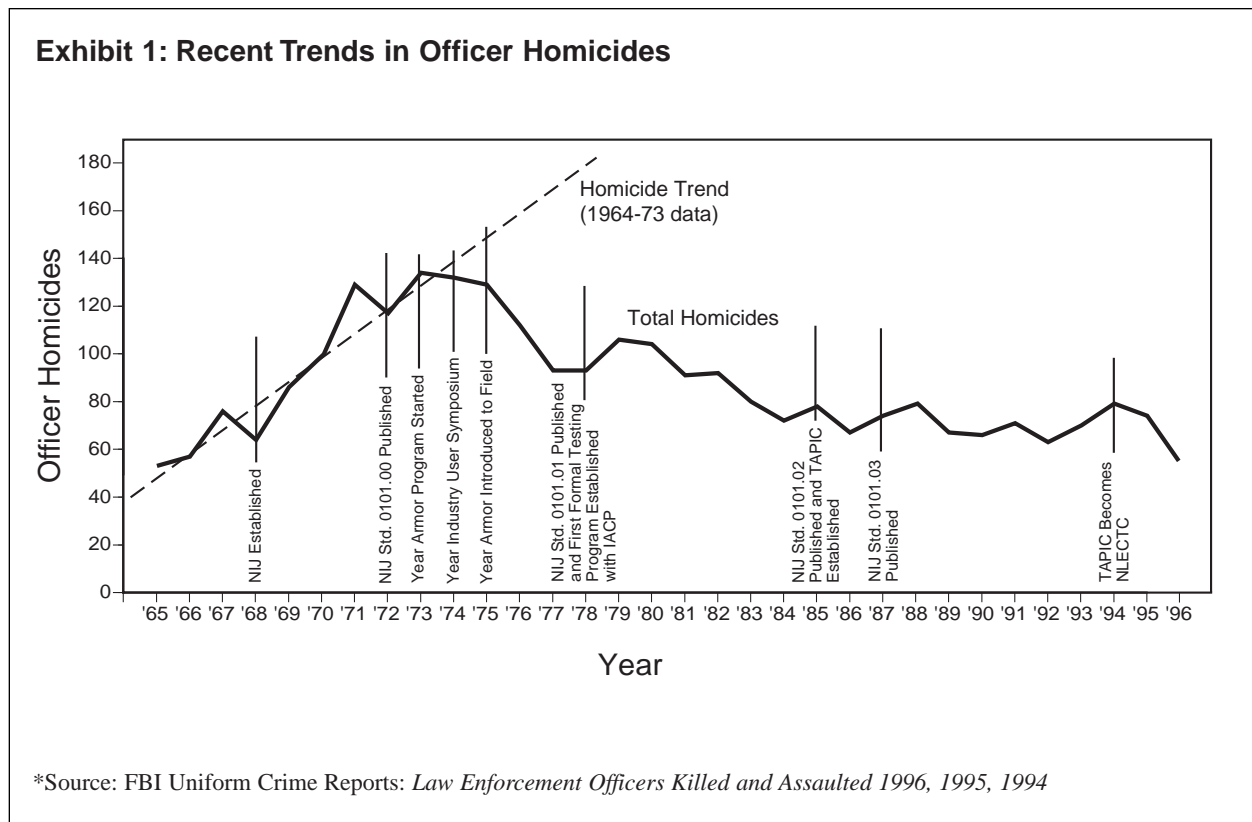
- Develops methods for testing equipment performance and examining evidentiary materials.
- Develops standards for equipment and operating procedures.
- Develops standard reference materials.
- Performs other scientific and engineering research as required.

Since the program began in 1971, OLES has coordinated the development of nearly 200 standards, user guides, and advisory reports. Topics range from performance parameters of police patrol vehicles, performance reports on various speed-measuring devices, body armor testing, to analytical procedures for developing DNA profiles.

The application of technology to enhance the efficiency and effectiveness of the criminal justice community continues to increase. The proper adoption of the products resulting from emerging technologies and the assessment of performance of equipment, systems, methodologies, etc., used by criminal justice practitioners constitute critical issues having safety and legal ramifications. The consequences of inadequate equipment performance or inadequate test methods can range from inconvenient to catastrophic. In addition, these deficiencies can adversely affect the general population when they increase public safety costs, preclude arrest, or result in evidence found to be inadmissible in court.

1. Introduction

Lightweight body armor has been widely available for use by law enforcement personnel for more than 20 years. The dramatic reduction in officer homicides following the introduction of body armor, as shown in exhibit 1, attests to the protection it provides. This success story extends far beyond protection from handguns—an estimated 2,150¹ lives have been spared, including cases in which body armor prevented serious injuries to officers from other types of assaults or accidents.



The National Institute of Justice² (NIJ) has developed standards for body armor performance through its Office of Law Enforcement Standards (OLES). Body armor has been tested as a part of the NLECTC voluntary equipment testing program to determine compliance with the NIJ standard, and NLECTC disseminates those test results and other pertinent information to the law enforcement and corrections communities. A consumer product list of armor models that comply with the requirements of the standard is available from NLECTC.³

While body armor is a household word in the law enforcement community, questions about its selection and use are frequently asked. This guide responds to commonly expressed concerns. It provides information to help determine what level of protection is consistent with the threats to

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which individual officers are exposed. It also discusses selection of armor from the variety of styles available, together with the proper care of armor in service. The NIJ standard is discussed in detail, as well as the use of the standard in armor procurement. In addition, the guide discusses administrative concerns, including the issue of replacing inservice armor, and describes other sources of information.

NIJ asks all departments to exercise prudent judgment in selecting armor appropriate to their needs. In so doing, NIJ urges proper attention to those factors that affect the wearability of armor in order to encourage routine, full-time use by all on-duty officers. The temptation to order armor that provides more protection than realistically needed should be resisted, because doing so may increase the likelihood that the armor will not be worn routinely.

2. Background

A History of Body Armor

Humans throughout recorded history have used various types of materials to protect themselves from injury in combat and other dangerous situations. At first, protective clothing and shields were made from animal skins. As civilizations became more advanced, wooden shields and then metal shields came into use. Eventually, metal was also used as “clothing,” what we now refer to as the suit of armor associated with the knights of the Middle Ages. However, with the advent of firearms (c.1500), most of the traditional protective devices were no longer effective. In fact, the only real protection available against firearms were man-made barriers, such as stone or masonry walls, or natural barriers, such as rocks, trees, and ditches.

One of the first recorded instances of the use of soft armor was by the medieval Japanese, who used armor manufactured from silk. Although the first U.S. law enforcement officer to lose his life in the line of duty, U.S. Marshall Robert Forsyth, was shot and killed in 1794,⁴ it was not until the late 19th century that the first use of soft armor in the United States was recorded. At that time, the military explored the possibility of using soft armor manufactured from silk. The project even attracted congressional attention after the assassination of President William McKinley in 1901. But while the garments were shown to be effective against low-velocity bullets (traveling at 400 feet per second (ft/s) or less), they did not offer protection against the new generation of handgun ammunition being introduced at that time that traveled at velocities of more than 600 feet per second. This, along with the prohibitive cost of manufacturing the garment (\$80 each, which amounts to approximately \$1,400 in 1998 dollars) made the concept unacceptable. Armor of this type was said to have been worn by Archduke Francis Ferdinand of Austria when he was killed by a shot to the head, thereby precipitating World War I.⁵

The U.S. Patent and Trademark Office lists records dating back to 1919 for various designs of bullet-resistant garments. One of the first documented instances where such a vest was demonstrated for use by law enforcement officers is detailed in the April 2, 1931 edition of the Washington, D.C., *Evening Star*, where a vest was demonstrated to members of the Metropolitan Police Department. However, none of these designs proved entirely effective or feasible for law enforcement or corrections use.

The next generation of ballistic vests was introduced during World War II. The “flak jacket,” constructed of ballistic nylon, provided protection primarily from munitions fragments and was ineffective against most pistol and rifle threats. These vests were also very cumbersome and bulky, and were restricted primarily to military use. It would not be until the late 1960s that new fibers were discovered that made today’s modern generation of concealable body armor possible.

The History of NIJ's Body Armor Testing Program

During the 1960s this country witnessed a dramatic rise in officer fatalities. From 1966 to 1971, the number of law enforcement officers killed each year in the line of duty more than doubled, from 57 to 129 (see exhibit 1). Concerned by this rapid increase in officer fatalities and recognizing that a majority of the homicides were inflicted with handguns, the National Institute of Law Enforcement and Criminal Justice (NILECJ)—predecessor of the National Institute of Justice (NIJ)—initiated a research program to investigate development of a lightweight body armor that on-duty police could wear full time.

The investigation readily identified new materials that could be woven into a lightweight fabric with excellent ballistic-resistant properties. Following initial laboratory research, the agency concluded that the objective of producing body armor suitable for full-time police use was achievable. In a parallel effort, the National Bureau of Standards' (now known as the National Institute of Standards and Technology) Law Enforcement Standards Laboratory (now known as the Office of Law Enforcement Standards (OLES)) developed a performance standard⁶ that defined ballistic-resistant requirements for police body armor. The National Bureau of Standards was a part of the NIJ Technology Assessment Program, which today is known as the National Law Enforcement and Corrections Technology Center (NLECTC).

Of all the equipment developed and evaluated in the 1970s by NIJ, one of its most significant achievements was the development of body armor that employed DuPont's Kevlar® ballistic fabric. Ironically, the fabric was originally intended to replace steel belting in vehicle tires. Lester Shubin, who served as NIJ Technology Assessment Program Manager from 1971–1991, recalls:

The Army notified me that DuPont had a new fabric to replace steel belting for high-speed tires. When I saw it, I realized it might be a great improvement over nylon for personal armor.

Nicholas Montanarelli, then an Army Land Warfare technology specialist, and I took a piece of Kevlar® to a gun range. We folded it over a couple of times and shot at it. The bullets didn't go through.

During the following 5 years, from 1971 to 1976, more than \$3 million of NIJ funds were devoted to the development of body armor. The research and development program was a team effort involving several of the most innovative and technologically advanced private and government organizations in the country. Contractors from the private sector were The Aerospace Corporation and MITRE Corporation. The U.S. Army's contribution included the efforts of Edgewood Arsenal, Aberdeen Proving Grounds, and Natick Laboratories. The Lawrence Livermore Laboratory and the National Bureau of Standards were also involved in the program, as were the Federal Bureau of Investigation (FBI) and the Secret Service.

The development of body armor by NIJ was a four-phase effort that took place over several years. The first phase involved testing Kevlar® fabric to determine whether it could stop a lead

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bullet. The second phase involved determining the number of layers of material necessary to prevent penetration by bullets of varying speeds and calibers and developing a prototype vest that would protect officers against the most common threats—the .38 Special and the .22 Long Rifle bullets. Bullets from 9mm, .45, and .32 caliber weapons were also investigated.

By 1973, researchers at the Army's Edgewood Arsenal responsible for vest design had developed a garment made of seven layers of Kevlar® fabric for use in field trials. During this preliminary testing, environmental trials determined that the penetration resistance of Kevlar® was degraded when wet. The bullet-resistant properties of the fabric also diminished upon exposure to ultraviolet light, including sunlight. Drycleaning agents and bleach also had a negative effect on the antiballistic properties of the fabric, as did repeated washing. To protect against these problems, the vest was designed with waterproofing, as well as with fabric coverings to prevent exposure to sunlight and other degrading agents.

The third phase of the initiative involved extensive medical testing to determine the performance level of body armor that would be necessary to save police officers' lives. It was clear to researchers that even when a bullet was stopped by the flexible fabric, the impact and resulting trauma from the bullet would leave a severe bruise at a minimum and, at worst, could kill by damaging critical organs. Subsequently, Army scientists designed tests to determine the effects of blunt trauma, which is injuries suffered from forces created by the bullet impacting the armor. A byproduct of the research on blunt trauma was the improvement of tests that measure blood gases, which indicate the extent of injuries to the lungs.

The final phase involved monitoring the armor's wearability and effectiveness. An initial test in three cities determined that the vest was wearable, it did not cause undue stress or pressure on the torso, and it did not prevent the normal body movement necessary for police work. In 1975, an extensive field test of the new Kevlar® body armor was conducted, with 15 urban police departments cooperating. Each department served a population larger than 250,000, and each had experienced officer assault rates higher than the national average. The tests involved 5,000 garments, including 800 purchased from commercial sources. Among the factors evaluated were comfort when worn for a full working day, its adaptability in extremes of temperature, and its durability through long periods of use.

Equally important in this test was the psychological effect of the garments on the officers—whether wearing them would enable them to be more confident or relaxed in their encounters with the public or inspire them to take more chances with their lives or the lives of others. The tests showed that the armor could be worn without restricting officers' ability to do their jobs and, more importantly, that the vests worked. The first instance of a vest's saving a participating officer's life occurred less than 6 months after it was issued to him. During the 1-year demonstration period, 18 shooting incidents occurred in which body armor successfully protected the officers. The demonstration project armor issued by NIJ was designed to ensure a 95-percent probability of survival after being hit with a .38 caliber bullet at a velocity of 800 ft/s. Furthermore, the probability of requiring surgery if hit by a projectile was to be 10 percent or less.

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A final report released in 1976 concluded that the new ballistic material was effective in providing a bullet-resistant garment that was light and wearable for full-time use. Private industry was quick to recognize the potential market for the new generation of body armor, and body armor became commercially available in quantity even before the NIJ demonstration program.

For the past 25 years, the routine use of body armor by law enforcement officers occurred primarily in the United States because assault by firearms on law enforcement officers in other countries was not as common. However, with the proliferation of international terrorism and related firearms attacks against officers, the use of body armor in other countries is becoming increasingly commonplace. NLECTC has seen a dramatic increase in the number of submissions of new body armor models from manufacturers around the world. The NIJ standard for police body armor has gained worldwide acceptance as a benchmark to judge the effectiveness of a given body armor model. In response, NIJ is reaching out to the international community in a cooperative effort for the development of future revisions of the standard.

Today, more than 50 manufacturers produce body armor and participate in NIJ's voluntary compliance testing program. Other types of bullet-resistant armor, which were much heavier and bulkier than vests made with the new technology, have virtually disappeared from the market. Estimates indicate that the body armor industry conducts \$200 million in business in the United States annually, the majority of which is for use related to law enforcement and the military.⁷

NIJ's body armor program was instrumental in developing a garment that is not only wearable, but that has contributed significantly to the safety of our Nation's law enforcement officers. Every facet of the development phase was aimed at protecting the life of the law officer on the street. This remains the program's purpose today.

3. Why Wear Body Armor?

The Cost

Since the death of U.S. Marshall Robert Forsyth more than 200 years ago, more than 14,000⁸ officers have fallen in the line of duty—many of these men and women killed by firearms.

The use of weapons of all types, particularly handguns by those with criminal intent, poses a constant threat to police officers, whether they are responding to a domestic quarrel or to an armed robbery. All too frequently, a domestic disturbance erupts into violence when family members redirect their anger toward the officer attempting to effect a peaceful resolution. Similarly, a routine traffic stop can result in an unexpected armed confrontation. At times like these, an officer needs the protection provided by body armor.

Logic dictates the routine use of body armor. Still there are those who do not wear it regularly, often in spite of departmental regulations to do so. Those who forsake the protection of armor constantly expose themselves to unnecessary pain and suffering or even death. They also fail to consider the potential impact of their actions on their families, who must suffer the anxiety of awaiting the uncertain outcome of surgery, the burden of caring for the injured or permanently disabled officer in the home, or—worse—the anguish of the officer’s death and the challenges of raising a family alone.

In addition to logic and the consideration of loved ones, case studies and statistics also support the importance of the routine use of body armor. As part of the Uniform Crime Reports, the Federal Bureau of Investigation (FBI) publishes its annual report *Law Enforcement Officers Killed and Assaulted* (LEOKA), which contains detailed analysis of the situations and circumstances surrounding assaults on law enforcement officers—a “must read” for all law enforcement personnel.

Ask yourself the following question: “*If I could do something that would increase my chances of surviving a shooting incident by 14 times, would I do it?*” If the answer is “Yes,” then you should wear your body armor every time you are on duty. The 1994 edition of the LEOKA report contains a summary of an FBI study that demonstrates that the risk of sustaining a fatal injury for officers who do not routinely wear body armor is **14 times** greater than for officers who do. (A copy of the report summary is included in appendix C of this guide.) This information alone should be sufficient to persuade even the least cautious individual about the benefits of the routine use of body armor.

The National Institute of Justice (NIJ) believes that it is in the best interest of all police departments to promote the full-time use of body armor. Aside from armor sparing officers and their families pain and suffering, the economic impact on a department when an officer is killed in the line of duty is staggering.

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The following statistics illustrate the importance of wearing body armor to the entire law enforcement community and beyond. Since 1973 and as of January 1, 1998, a total of 2,150 “saves” have been attributed to the use of body armor. Fifty-eight percent of these saves were connected with felonious assaults and 42 percent with accidents (e.g., vehicular). According to the International Association of Chiefs of Police (IACP)/DuPont Kevlar Survivors’ Club®, the estimated cost of an officer’s death is \$1.3 million. This figure is based on funeral expenses, death and pension benefits, and the cost to a department to hire and train a replacement officer.

In 1976, the Public Safety Officers’ Benefits (PSOB) Act (42 U.S.C. 3796, et. seq.) was enacted into law by Congress to assist the families of State and local law enforcement officers and firefighters killed or permanently disabled in the line of duty. The families of these officers slain on or after September 29, 1976 were eligible to receive a \$50,000 death benefit payment. In 1984, families of Federal law enforcement officers and firefighters killed or disabled in the line of duty were also made eligible. The benefit was increased to \$100,000 in 1988, with a provision that this amount would be adjusted each October 1 to reflect the percentage of increase in the Consumer Price Index. For fiscal year (FY) 1998, the amount was \$141,556. Since 1977, the Bureau of Justice Assistance (BJA), which administers this program, has received an average of 275 claims each year. In FY 1997, the PSOB program paid out a total of \$23,590,000 in death and disability benefits to qualifying survivors under this program.

In addition to the Federal PSOB program, many States also have benefits available to the survivors; however, each State varies as to the benefits they provide. Among the various benefits available are a one-time death benefit, a pension payment, waiver of property taxes, tuition-free education, and continuation of health care coverage for surviving children and/or spouses.

Concerns of Police Survivors (COPS), an organization dedicated to assisting and providing resources to the families of slain officers, has compiled information on benefits available to law enforcement survivors in all 50 States, the District of Columbia, and Puerto Rico. Information is updated on an ongoing basis. This information includes benefits sources and contact information. Information on how to contact COPS is included in the Resource List (appendix A) at the end of this publication.

The Threat

The current generation of body armor was developed specifically to protect against injury from assault with handguns. A review of the statistics concerning weapons confiscated nationwide during the period from 1964 to 1974 identified the .38 caliber handgun, firing bullets at a velocity of 800 ft/s, as the most common weapon threat to officers. In fact, .38 caliber and smaller handguns accounted for more than 85 percent of the confiscated weapons. Since the introduction of body armor in the mid-1970s, a review of the *Law Enforcement Officers Killed and Assaulted* report continues to support the fact that the most common threat faced by law enforcement officers is handgun assaults. However, trends indicate that the 9mm semiautomatic pistol has surpassed the .38 caliber handgun as the most common threat (see exhibit 2).

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Exhibit 2: Officers Feloniously Killed by Handguns

Type and Size of Firearm As Reported* (1985–1996)													
Caliber of Firearm	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	Caliber Totals
Handgun													
.22 Caliber	4	1	5	3	1	3	2	3	2	1	5	3	33
.22 Magnum	0	0	0	0	0	0	1	0	0	0	0	0	1
.25 Caliber	3	3	2	1	2	3	0	2	2	2	0	4	24
.32 Caliber	1	1	0	0	0	3	2	0	1	4	1	4	17
.357 Magnum	4	3	1	5	9	12	10	7	15	13	14	15	108
.38 Caliber	5	6	11	11	13	10	18	19	23	18	20	17	171
.380 Caliber	6	6	6	9	2	1	0	1	2	2	0	3	38
9 Millimeter	10	12	26	11	8	12	8	4	6	4	4	3	108
9 x 18 Millimeter	1	0	0	0	0	0	0	0	0	0	0	0	1
.40 Caliber	2	3	2	3	0	0	0	0	0	0	0	0	10
.41 Magnum	0	0	0	0	0	0	0	0	0	0	0	1	1
.44 Magnum	1	3	2	0	1	0	1	0	6	3	1	1	19
.45 Caliber	3	4	2	3	2	4	2	2	4	0	5	3	34
.455 Caliber	0	0	1	0	0	0	0	0	0	0	0	0	1
Caliber Not Reported	4	1	5	4	4	2	4	2	1	1	1	4	33
Yearly Total	44	43	63	50	42	50	48	40	62	48	51	58	599

*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted 1996, 1995, 1994*

When an individual is hit by a bullet, the extent of the injury sustained depends on where the bullet strikes the body and the path or trajectory of the bullet into or through the body. Injury to the vital organs is most often fatal. Thus, the armor's primary and most obvious purpose is to prevent a bullet from penetrating the torso.

In the case of hard armor, such as metal, rigid reinforced plastic, or ceramic materials, it is possible to use armor of such a thickness that it does not appreciably deform from the bullet impact. If, however, the armor that covers the torso deforms from the bullet impact, the surface of the armor against the body at the point of impact will be forced against or into the skin and flesh. Unlike a penetrating wound, in which the skin is broken and the bullet tears through the body, the deformation of armor from bullet impact results in blunt trauma. This type of nonpenetrating injury can cause severe contusions (bruises) or internal damage and can even result in death. As a result, this NIJ standard also evaluates the capabilities of the armor to prevent injury from blunt trauma.

Simply speaking, the design of ballistic-resistant armor requires identifying the threat, selecting a material or combination of materials that will resist that threat, and determining the number of layers of material necessary to prevent both penetration and blunt trauma injury. In designing armor, the armor's final weight is an important factor in the selection of the ballistic-resistant material or materials to be used. The goal is to design the lightest possible unit that achieves the desired protection while still providing comfort and not restricting movement.

The degree of threat to armor from handguns depends on many factors: caliber, bullet configuration and composition (e.g., lead roundnose, jacketed hollow-point, full metal jacketed, armor piercing), weight, and impact velocity. Thus, armor that defeats a specific projectile at one impact velocity may not defeat the same caliber projectile at a higher velocity or of a different composition or configuration.

On the whole, a continuous range of threat levels undoubtedly exists for the different weapon and ammunition combinations available. As with clothing, which allows selection from a limited range of garment type and weight depending on climate and season, it has proven satisfactory to establish six armor types (protection level classifications) that enable the selection of armor to protect against most common threats—including sporting and armor-piercing rifle bullets.

All departments should periodically review the information used to select the level of protection (armor type classification) when the armor was purchased. Evaluate changes in service weapons or ammunition with respect to the type of armor used by officers. Equally important are changes in the weapons or ammunition of the local criminal population. If changes have occurred and increased the threat to the officers, the department should consider upgrading its armor.

The details of this armor classification and selection are discussed in detail in chapter 5 and 6. For the moment, it is sufficient to recognize the importance of being realistic in assessing the firearm threat to officers. The weight and bulk of body armor can increase significantly as greater threat protection is demanded; both of these factors can discourage full-time use of body armor.

Not Just Bullets

The original NIJ body armor effort focused solely on the urgent need to protect law enforcement personnel from handgun assault. As with most new technology, body armor has proven useful in ways not thought of when first put into service. The same properties that provide ballistic protection—resistance to penetration and blunt trauma—when combined with abrasion resistance have also saved many officers from serious physical injury in vehicular accidents.

In one incident, during the course of a routine patrol, an officer was negotiating a sweeping right-hand curve at a high rate of speed when the vehicle ran off the edge of the pavement. As the vehicle was brought back onto the pavement, the officer lost control. After fishtailing several times, the vehicle became airborne and crashed head on into a rocky hillside. The officer

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suffered a fractured sternum, sprained right thumb, possible concussion, and pain in the area of the neck. There is every reason to believe that the body armor the officer was wearing saved the officer's life.

In another incident, an officer in a patrol car was following a slow-moving vehicle and was struck from behind by a vehicle traveling at approximately 60 mph. Again, body armor was credited with preventing serious injury.

Medical experts have concluded that body armor definitely mitigates injury in head-on collisions when the driver is thrown against the steering wheel, particularly when the seat belt is fastened. The development of new safety-related technologies in vehicles, such as air bags, may lessen the severity of injuries routinely sustained in these types of accidents

Officers assigned to motorcycle duty are especially vulnerable to injury in vehicular accidents. A member of the California Highway Patrol was traveling at approximately 45 mph when he heard the sound of a vehicle approaching rapidly from the rear. He was attempting to move to the right when he was struck by the vehicle in the left rear. The motorcycle spun counterclockwise. He was thrown from the motorcycle, landing on his back and sliding on the pavement for approximately 100 feet before coming to rest. He sustained only minor injuries to his right elbow and right leg. This convincing example demonstrates the nonballistic protection that body armor can offer. In addition, body armor has also protected numerous officers from injury from physical assault with 2 by 4's, baseball bats, and other rigid objects.

It should be noted that concealable body armor is potentially vulnerable to knife attack; hence, all officers should exercise due caution when confronted with these situations. However, numerous incidents have been documented in which body armor lessened injury. Several manufacturers currently market vests they claim offer protection against knife attacks, although most of these vests carry warnings indicating that they do not provide protection against *all* sharp-edged and pointed threats, just as a ballistic-resistant vest cannot be totally bulletproof.

2,000-Plus Reasons

The first recorded incident of a U.S. law enforcement officer's life being saved as a result of wearing a concealable ballistic vest occurred May 17, 1973, in Detroit, Michigan. Police Officer Ron Jagielski, along with several other officers, was working on a plainclothes assignment involving narcotics trafficking. Ready to enter the residence under surveillance and make the bust, Jagielski was hit in the chest when a bullet pierced the building's front door. A .38 caliber special bullet was later found embedded in his ballistic vest, just below the area of his heart. Had it not been for the protection afforded by the body armor, Jagielski would surely have suffered a fatal injury.

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Nearly a quarter-century later, on January 3, 1997, Deputy Henry Huff became the 2,000th law enforcement official to be placed on the IACP/DuPont list of those saved by concealable body armor. A member of the Walton County, Georgia, Sheriff's Office, Huff was shot at pointblank range during a traffic stop by a 16-year-old male armed with a 9mm weapon. The surveillance camera in Huff's squad car caught the entire incident on videotape. Despite being shot twice in the chest, Huff was spared from serious injury. He has since returned to duty.

In 1987, a study by DuPont found that while most police officers recognized the dangers of their jobs and 65 percent of those surveyed owned body armor, only 15 to 20 percent actually used it. The reasons given for not wearing body armor ranged from legitimate concerns such as comfort and weight, to misconceptions about an officer's ability to survive blunt trauma caused by a bullet that has been stopped by a vest.

In that same year (1987), the International Association of Chiefs of Police Board of Officers authorized the formation of the IACP/DuPont Kevlar Survivors' Club®. The objectives of this club are to:

- Reduce death and disability by encouraging the increased wear of personal body armor through documentation of the armor's effectiveness.
- Recognize those individuals who, as a result of wearing personal body armor, have survived a life-threatening incident.
- Serve the law enforcement community by collecting these important data and sharing valuable information related to these survivor incidents.

By publishing the accounts of saves in *Police Chief* magazine and engaging in other supportive efforts, the Survivors' Club has helped educate law enforcement officers about the benefits of always wearing body armor. Many departments now routinely provide body armor and mandate its wear while officers are on duty. In some locations, concerned citizens have undertaken fundraising activities to purchase body armor for local law enforcement officers.

The dramatic increase in the general acceptance of body armor can be shown by a 1993 Bureau of Justice Statistics (BJS) survey of law enforcement agencies that revealed that 539 of the 661 agencies surveyed (81.5 percent) either provide body armor or cash allowances to purchase body armor to all of their uniformed patrol officers.¹⁰ In addition, 196 (or 29.7 percent) of those agencies had a mandatory wear policy. In comparison, the same survey conducted by BJS in 1987 indicated that only 28 percent of agencies surveyed provided armor or a cash allowance to purchase armor.¹¹ Also, according to the 1993 BJS survey, a third of all local police departments, including half of those serving a population of 1 million or more, required all regular field officers to wear body armor while on duty. Departments with such a requirement employed 41 percent of all local police officers in 1993, compared to 32 percent in 1990, the survey found.

4. Body Armor Construction

How Does Body Armor Work?

When a handgun bullet strikes body armor, it is caught in a “web” of very strong fibers. These fibers absorb and disperse the impact energy that is transmitted to the vest from the bullet, causing the bullet to deform or “mushroom.” Additional energy is absorbed by each successive layer of material in the vest, until such time as the bullet has been stopped.

Because the fibers work together both in the individual layer and with other layers of material in the vest, a large area of the garment becomes involved in preventing the bullet from penetrating. This also helps in dissipating the forces which can cause nonpenetrating injuries (what is commonly referred to as “blunt trauma”) to internal organs. Unfortunately, at this time no material exists that would allow a vest to be constructed from a single ply of material.

Currently, today’s modern generation of concealable body armor can provide protection in a variety of levels designed to defeat most common low- and medium-energy handgun rounds. Body armor designed to defeat rifle fire is of either semirigid or rigid construction, typically incorporating hard materials such as ceramics and metals. Because of its weight and bulkiness, it is impractical for routine use by uniformed patrol officers and is reserved for use in tactical situations where it is worn externally for short periods of time when confronted with higher level threats.

Methods of Construction

Typically, concealable body armor is constructed of multiple layers of ballistic fabric or other ballistic-resistant materials, assembled into the “ballistic panel.” The ballistic panel is then inserted into the “carrier,” which is constructed of conventional garment fabrics such as nylon or cotton. The ballistic panel may be permanently sewn into the carrier or may be removable. Although the overall finished product looks relatively simple in construction, the ballistic panel is very complex.

Ballistic fabric is available from a number of manufacturers in various styles and compositions, each type having unique ballistic-resistant properties. The body armor manufacturer may construct a given model of ballistic panel from a single fabric style or from two or more styles in combination. The location and number of layers of each style within the multiple-layer ballistic panel influence the overall ballistic performance of the panel. In addition, some manufacturers coat the ballistic fabric with various materials. For example, the manufacturer may add a layer of nonballistic material for the sole purpose of increasing blunt trauma protection. Even composites of two or more different ballistic materials are available. As a consequence, it is impossible to compare one product with another based solely on the number of fabric layers in the ballistic panel.

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The manner in which the ballistic panels are assembled into a single unit also differs from one manufacturer to another. In some cases, the multiple layers are bias stitched around the entire edge of the panel; in others, the layers are tack stitched together at several locations. Some manufacturers assemble the fabrics with a number of rows of vertical or horizontal stitching; some may even quilt the entire ballistic panel. No evidence exists that stitching impairs the ballistic-resistant properties of a panel. Instead, stitching tends to improve the overall performance, especially in cases of blunt trauma, depending upon the type of fabric used.

The differences between ballistic panels in various manufacturers' products result from individual design concepts meant to achieve a given level of ballistic performance with minimum weight and maximum comfort or wearability. If armor has been demonstrated to provide the desired level of protection in accordance with the NIJ standard, the user should not be concerned with the design, but should look for proper fit and comfort.

Body armor intended for routine use is most often designed to be worn beneath the normal uniform shirt. Again, manufacturers tend to design different methods of attaching armor to the body. Hook-and-pile fasteners are common, as are "D" ring tightening straps. With the exception of metal fasteners of any type (which can deflect a bullet on impact and pose a hazard), the method of attachment is a matter of personal preference.

Since 1987, the National Law Enforcement and Corrections Technology Center (NLECTC) has tested more than 2,300 models of body armor. Of these, more than 1,400 comply with the requirements of the National Institute of Justice Standard and are listed in the *Police Body Armor Consumer Product List (CPL)*, available from NLECTC. The number of body armor configurations available (including armor designed specifically for female officers) makes it possible for an officer to find comfortable armor suitable for routine use, consistent with his or her personal taste in appearance.

Materials Used

Note: The following information has been prepared from product literature supplied by the manufacturer. All product descriptions and performance claims are the manufacturer's and do not represent findings or endorsement of these claims by the National Institute of Justice, U.S. Department of Justice; Office of Law Enforcement Standards, U.S. Department of Commerce; or Aspen Systems Corporation.

Several manufacturers have been involved in developing and refining materials used in body armor. DuPont has developed law enforcement protection products for more than 25 years. Its Kevlar® brand fiber, first developed in 1965, was the first material identified for use in the modern generation of concealable body armor. Kevlar® is a manmade organic fiber, with a combination of properties allowing for high strength with low weight, high chemical resistance, and high cut resistance. Kevlar® is also flame resistant; does not melt, soften, or flow; and the fiber is unaffected by immersion in water (see the wet testing discussion in chapter 5).

Kevlar® 29, introduced in the early 1970s, was the first generation of bullet-resistant fibers developed by DuPont and helped to make the production of flexible, concealable body armor practical for the first time. In 1988, DuPont introduced the second generation of Kevlar® fiber, known as Kevlar® 129. According to DuPont, this fabric offered increased ballistic protection capabilities against high-energy rounds such as the 9mm FMJ. In 1995, Kevlar® Correctional™ was introduced, which provides puncture-resistant technology to both law enforcement and correctional officers against puncture-type threats.

The newest addition to the Kevlar® line is Kevlar® Protera, which DuPont made available in 1996. DuPont contends that the Kevlar® Protera is a high-performance fabric that allows lighter weight, more flexibility, and greater ballistic protection in a vest design due to the molecular structure of the fiber. Its tensile strength and energy-absorbing capabilities have been increased by the development of a new spinning process.

Spectra® fiber, manufactured by AlliedSignal, is an ultra-high-strength polyethylene fiber. Ultra high molecular weight polyethylene is dissolved in a solvent and spun through a series of small orifices, called spinnerets. This solution is solidified by cooling, and the cooled fiber has a gel-like appearance. The Spectra® fiber is then used to make Spectra Shield® composite. A layer of Spectra Shield® composite consists of two unidirectional layers of Spectra® fiber, arranged to cross each other at 0- and 90-degree angles and held in place by a flexible resin. Both the fiber and resin layers are sealed between two thin sheets of polyethylene film, which is similar in appearance to plastic food wrap. According to AlliedSignal, the resulting nonwoven fabric is incredibly strong, lightweight, and has excellent ballistic protection capabilities. Spectra Shield® is made in a variety of styles for use in both concealable and hard armor applications.

AlliedSignal also uses the Shield Technology process to manufacture another type of shield composite called Gold Shield®. Gold Shield® is manufactured using aramid fibers in place of the Spectra fiber. Gold Shield® is currently made in three types: Gold Shield® LCR and Gold-Flex®, which are used in concealable body armor; and Gold Shield® PCR, which is used in the manufacture of hard armor, such as plates and helmets.

Another manufacturer, Akzo Nobel, has developed various forms of its aramid fiber TWARON® for body armor. According to Akzo Nobel, this fiber uses 1,000 or more finely spun single filaments that act as an energy sponge, absorbing a bullet's impact and quickly dissipating its energy through engaged and adjacent fibers. Because more filaments are used, the impact is dispersed more quickly. Akzo claims their patented Microfilament technology allows maximum energy absorption at minimum weights while enhancing comfort and flexibility.

Akzo Nobel maintains that the use of TWARON® in body armor significantly reduces the overall weight of the finished product, thus making vests more comfortable. Akzo also contends that stitching panels made from layers of TWARON® is largely unnecessary, and that the lack of stitching contributes to a lighter weight and softer feel while affording the same protection.

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Another fiber used to manufacture body armor is Dyneema®. Originated in the Netherlands, Dyneema® has an extremely high strength-to-weight ratio (a 1-mm-diameter rope of Dyneema can bear up to a 240-kg load), is light enough that it can float on water, and has high energy absorption characteristics.

All fibers and materials noted in this chapter have a wide variety of uses in addition to ballistic garments. They are used for other types of protective clothing and equipment (e.g., bicycle and skateboarding helmets), marine and aircraft components, industrial cables, and recreational equipment such as fishing rods and tennis rackets. The materials described are some of the most commonly used; other materials (e.g., ballistic nylon) can also be used.

The introduction of newer, high-performance fibers has dramatically decreased the weight and bulk of today's body armor and increased its comfort and wearability. It can be anticipated that newer materials will be developed and in conjunction with further advances in ballistic vest design, technology will continue to enhance the performance and comfort of tomorrow's body armor.

5. The NIJ Standard

The National Institute of Justice (NIJ) Standard for the Ballistic Resistance of Police Body Armor was developed by the National Institute of Standards and Technology's (NIST's) Office of Law Enforcement Standards (OLEs) and issued by NIJ as a voluntary national standard. This is a performance rather than a design standard, as are most OLES standards. Performance standards clearly specify a minimum satisfactory level of performance for each attribute that is critical to the equipment's intended use. In contrast, design standards specify the manner in which an item of equipment must be manufactured. Performance standards encourage design innovation and the use of advanced technology, addressing critical requirements only and not such attributes as comfort, color, or style—which are generally matters of user perception or preference.

The administrative procedures for NIJ's body armor compliance-testing program, which is administered by the National Law Enforcement and Corrections Technology Center (NLECTC), are designed to ensure the integrity of the test results. A series of pre- and post-test checks and balances ensure the laboratory's conformance to the NIJ testing procedure. When a manufacturer elects to have a model of armor tested, the test samples are delivered to NLECTC, where the labels and workmanship are inspected before the samples are given to an independent laboratory for testing. A 2-week period is allocated to accomplish the control function before the scheduled testing date. Following testing, the samples are returned to NLECTC, where test results are verified. The tested samples are then placed in archival storage.

The NIJ body armor testing program relies on voluntary participation by manufacturers. However, many police departments require that armor be tested by NLECTC and found in compliance with the NIJ standard before they will purchase the armor. As a result, most manufacturers design their armor to comply with the standard and have each model tested for compliance by NLECTC. Whenever NIJ develops a new standard, NLECTC distributes the revision to industry representatives for their comments.

Developing the Standard

The selection of body armor has become increasingly complex as manufacturers have developed numerous models and designs, the variety of ballistic fabric styles has increased, and the protection requirements of police agencies have changed. All of these factors have necessitated changes in the NIJ body armor standard. The current edition, which was issued in April 1987,¹² is the third revision of the 1972 base document.

The first standard (.00). NIJ's first standard, 0101.00, *Ballistic Resistance of Police Body Armor*, was published in March 1972 in response to the law enforcement community's request for a benchmark against which to measure competing manufacturer claims. This first standard provided requirements only for resistance to actual penetration of the vest by a bullet and defined only three levels of protection from various threats. The issue of whether the armor could prevent injury from blunt trauma was not addressed.

The next step (.01). In 1975, NIJ requested that the Law Enforcement Standards Laboratory, (LESL), the predecessor to OLES, begin revision of the .00 standard to take into account contemporary research on blunt trauma and the degradation of armor when wet. A revised standard was published in December 1978 as STD-0101.01¹³ to introduce the backface signature test for blunt trauma and wet testing.

At approximately the same time, the law enforcement community asked NIJ to establish an equipment testing program to provide independent verification of body armor compliance to the NIJ standard. NIJ entered into a cooperative agreement with the International Association of Chiefs of Police (IACP) to conduct the testing. The first results were published in 1978. Since then, the models (and the names of their manufacturers) that pass compliance testing have been published in the *Police Body Armor Consumer Product List (CPL)*, periodically published by NLECTC. NLECTC also publishes other documents and guides, such as this one, to help police departments select and procure body armor.

Responding to change (.02). In March 1985, NIJ amended the standard to take into account armors' susceptibility to angle shots and multishot assaults.¹⁴

The current standard (.03). The current NIJ standard, 0101.03, published in April 1987, clarified labeling requirements, acceptance criteria, and backface signature measurement procedures. NIJ also strengthened its administrative procedures for archiving models.

The future. Since the introduction of the .03 standard, there have been considerable advances in body armor materials, design technology, threats, and test methods and procedures. Future revisions of the standard will incorporate these changes to ensure the highest levels of safety. The development of test methods to verify the ongoing performance of body armor units currently in use will also be addressed.

NIJ's policy on body armor has always been that preserving the life of the police officer is the sole criterion on which to judge body armor effectiveness. At present, an officer may select a garment that corresponds to an appropriate threat level and be confident that armor in compliance with NIJ's standard will defeat the stated threat level.

Armor Classification

NIJ Standard-0101.03 establishes six formal armor classification types, as well as a seventh special type, as follows:

Type I (.22 LR; .38 Special). This armor protects against .22 Long Rifle High-Velocity lead bullets, with nominal masses of 2.6 g (40 gr), impacting at a velocity of 320 m/s (1,050 ft/s) or less, and against .38 Special roundnose lead bullets, with nominal masses of 10.2 g (158 gr), impacting at a velocity of 259 m/s (850 ft/s) or less. It also provides protection against most other .25 and .32 caliber handgun rounds.

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Type I body armor is light. This is the minimum level of protection every officer should have, and the armor should be routinely worn at all times while on duty. Type I body armor was the armor issued during the NIJ demonstration project in the mid-1970s. Most agencies today, however, because of increasing threats, opt for a higher level of protection.

Type II–A (Lower Velocity .357 Magnum; 9mm). This armor protects against .357 Magnum jacketed soft-point bullets, with nominal masses of 10.2 g (158 gr), impacting at a velocity of 381 m/s (1,250 ft/s) or less, and against 9mm full-metal jacketed bullets, with nominal masses of 8.0 g (124 gr), impacting at a velocity of 332 m/s (1,090 ft/s) or less. It also provides protection against such threats as .45 Auto., .38 Special +P, and some other factory loads in caliber .357 Magnum and 9mm, as well as the Type I threats.

Type II–A body armor is well suited for full-time use by police departments, particularly those seeking protection for their officers from lower velocity .357 Magnum and 9mm ammunition.

Type II (Higher Velocity .357 Magnum; 9mm). This armor protects against .357 Magnum jacketed soft-point bullets, with nominal masses of 10.2 g (158 gr), impacting at a velocity of 425 m/s (1,395 ft/s) or less, and against 9mm full-jacketed bullets, with nominal velocities of 358 m/s (1,175 ft/s). It also protects against most other factory loads in caliber .357 Magnum and 9mm, as well as the Type I and II–A threats.

Type II body armor is heavier and more bulky than either Types I or II–A. It is worn full time by officers seeking protection against higher velocity .357 Magnum and 9mm ammunition.

Type III–A (.44 Magnum; Submachine Gun 9mm). This armor protects against .44 Magnum, lead semi-wadcutter bullets with gas checks, nominal masses of 15.55 g (240 gr), impacting at a velocity of 426 m/s (1,400 ft/s) or less, and against 9mm full-metal jacketed bullets, with nominal masses of 8.0 g (124 gr), impacting at a velocity of 426 m/s (1,400 ft/s) or less. It also provides protection against most handgun threats, as well as the Type I, II–A, and II threats.

Type III–A body armor provides the highest level of protection currently available from concealable body armor and is generally suitable for routine wear in many situations. However, departments located in hot, humid climates may need to evaluate the use of Type III–A armor carefully.

Type III (high-powered rifle). This armor, normally of hard or semirigid construction, protects against 7.62mm full-metal jacketed bullets (U.S. military designation M80), with nominal masses of 9.7 g (150 gr), impacting at a velocity of 838 m/s (2,750 ft/s) or less. It also provides protection against threats such as 223 Remington (5.56mm FMJ), 30 Carbine FMJ, and 12-gauge rifled slug, as well as the Type I through III–A threats.

Type III body armor is clearly intended only for tactical situations when the threat warrants such protection, such as barricade confrontations involving sporting rifles.

Type IV (armor-piercing rifle). This armor protects against .30–06 caliber armor-piercing bullets (U.S. military designation APM2), with nominal masses of 10.8 g (166 gr) impacting at a

velocity of 868 m/s (2,850 ft/s) or less. It also provides at least single-hit protection against the Type I through III threats.

Type IV body armor provides the highest level of protection currently available. Because this armor is intended to resist “armor piercing” bullets, it often uses ceramic materials. Such materials are brittle in nature and may provide only single-shot protection, since the ceramic tends to break up when struck. As with Type III armor, Type IV armor is clearly intended only for tactical situations when the threat warrants such protection.

Special type. A purchaser who has a special requirement for a level of protection other than one of the above standard threat levels should specify the exact test rounds and minimum impact velocities to be used and indicate that this standard shall govern in all other respects.

Model and Style Designation

A manufacturer can, and frequently does, use identical ballistic panel construction to produce several different configurations of armor, such as an undergarment or an outerwear jacket used by plainclothes officers (e.g., denim jacket, simulated down vest), each of which provides the same level of ballistic protection.

For the purposes of the NLECTC body armor compliance procedures, the following definitions have been adopted:

Body armor model. A manufacturer designation (name, number, or other description) that serves to uniquely identify a specific configuration of body armor based upon the details of the ballistic panel construction and the manner in which the armor is held in place upon the torso. Separate model designations must be assigned to armor designed to fit the female and male torso.

Body armor style. A manufacturer designation (name, number, or other description) that is used to distinguish between different configurations of body armor product line, each of which is a minor stylistic variation of the same model of ballistic panel but does not have the potential to negatively affect the originally tested ballistic performance level of that model.

The distinctions between body armor model and style were established to eliminate the need to retest a given body armor model for compliance with the NIJ standard each time a manufacturer incorporates the model into a different style of armor.

The intent of the NIJ program is to ensure that armor purchased for use by law enforcement personnel provides the rated level of protection. However, NIJ recognizes that individual departments often desire minor modifications to an armor model that do not have the potential to reduce the level of protection of the armor model. There are a number of variations in configuration that a manufacturer can make to a model without the necessity of assigning a new model number to the modified units. These include:

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- 1) Changes in color of the carrier material.
- 2) Changes in the placement of pockets or of straps designed to carry police equipment.
- 3) Changes in fabric used to encase ballistic panels; provided, however, that if the fabric used in the model tested for compliance was waterproof, the replacement fabric must exhibit equal or improved resistance to water.
- 4) Changes in the fabric of the carrier material; provided, however, that if any portion of the carrier of the sample tested for compliance contained elastic materials such as rubber or foam rubber, the replacement fabric must provide an equivalent amount and thickness of such material to maintain the original energy absorption.
- 5) Changes in the perimeter shape of the ballistic panels; including the shape and size of neck and arm openings, and extending or reducing the overall width of the ballistic panels to increase, decrease, or eliminate overlap of the ballistic panels.
- 6) Changes to the kind, style, or location of fabric attachment and adjustment mechanisms; provided however, that such changes do not incorporate hard materials that could potentially be a ricochet hazard.
- 7) Changing from a removable panel carrier to one in which the ballistic panel is not removable.

The manufacturer ***must assign a new model number and submit the new model for compliance testing*** if any of the following modifications are made to a model on the CPL:

- 1) The addition or elimination of any layers of ballistic-resistant materials of the ballistic panel resulting in a different number of total layers in the panel.
- 2) For vests consisting of multiple styles or types of materials, any alteration or changes to the sequence in which the layers are arranged or configured within the ballistic panel. Changes, unless specifically authorized by NIJ, include but are not limited to:
 - Changes in the style (e.g., base yarn, weave design and count, fiber area, weight, and/or resin composition) of woven and nonwoven fabric are considered changes in the material.
 - Fabrics woven from yarn produced using fibers manufactured by various chemical suppliers are considered to be different materials.
 - Laminates made from different chemical compositions (i.e., different chemical abstract service numbers) are considered to be different materials.
 - Changes in the treatment of materials (e.g., waterproofed versus nonwaterproofed or impregnated versus nonimpregnated or alternate impregnation processes) constitutes the use of different materials.
- 3) Any change in the manner in which the ballistic panel is assembled; (e.g., the addition or elimination of stitching and changes in stitch density or material).

SELECTION AND APPLICATION GUIDE TO POLICE BODY ARMOR

- 4) Modifying an approved side-opening (solid front/back panels) concealable vest to create a front- or back-opening (commonly referred to as “tactical” or “detective” style) vest.
- 5) Changing from a permanent/nonremovable carrier to a removable ballistic carrier.
- 6) Changes to the closure mechanism (including the type or location, interior flaps or panels associated with the mechanism and any exterior cover device) of front- or back-opening armor configurations.
- 7) Changing from a snug-fitting carrier to one that allows too much movement of the ballistic panel (e.g., ballistic panel sized to fit 38-inch chest inserted in a size-40 carrier).

Modifications not specifically addressed in these guidelines will be reviewed on a case-by-case basis and a determination rendered by NIJ. In all cases, the originally tested and archived vest will serve as the benchmark to determine if a change has occurred.

Once a model of armor has been tested and approved, and a letter of compliance is issued by the National Law Enforcement and Corrections Technology Center (NLECTC), it is the responsibility of the manufacturer to ensure that **all subsequent production units** sold to law enforcement agencies or personnel labeled as being in compliance with NIJ Standard-0101.03 are constructed identically to the samples of the model submitted to NLECTC for testing and found to comply with the requirements of the standard.

Requirements

The performance requirements of NIJ Standard–0101.03, which were developed with the active participation of body armor manufacturers, ensure that each armor type will provide a well-defined minimum level of ballistic protection.

Exhibit 3, reproduced from the standard, identifies the specific bullets and impact velocities that each armor type must withstand.

Types I, II–A, II, and III–A armor are required to prevent penetration from the impact of six bullets at specified velocities and locations for two types of ammunition. Two of the impacts in each six-shot sequence must be at a 30° angle. Furthermore, the deformation of the backing material (a measure of blunt trauma protection) must not exceed 44mm (1.73 in). The armor must meet these requirements while both dry and wet.

Type III armor requirements are identical to those above, except that only one type of ammunition is specified, and all six test rounds are fired perpendicular to the surface of the armor.

Type IV armor is required to resist penetration from only a single type of ammunition (armor piercing) and is only required to prevent penetration from a single perpendicular impact.

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Exhibit 3: Test Summary

Armor type	Test variables				Performance requirements		
	Test Round	Test Ammunition	Nominal Bullet Mass	Minimum required Bullet Velocity	Required fair hits per armor part at 0° angle of incidence	Maximum depth of deformation	Required fair hits per armor part at 30° angle of incidence
I	1	.38 Special RN Lead	10.2 g 158 gr	259 m/s (850 ft/s)	4	44 mm (1.73 in)	2
	2	.22 LRHV Lead	2.6 g 40 gr	320 m/s (1050 ft/s)	4	44 mm (1.73 in)	2
II-A	1	.357 Magnum JSP	10.2 gr 158 gr	381 m/s (1250 ft/s)	4	44 mm (1.73 in)	2
	2	9 mm FMJ	8.0 g 124 gr	332 m/s (1090 ft/s)	4	44 mm (1.73 in)	2
II	1	.357 Magnum JSP	10.2 158 gr	425 m/s (1395 ft/s)	4	44 mm (1.73 in)	2
	2	9 mm FMJ	8.0 g 124 gr	358 m/s (1175 ft/s)	4	44 mm (1.73 in)	2
III-A	1	.44 Magnum Lead SWC Gas Checked	15.55 g 240 gr	426 m/s (1400 ft/s)	4	44 mm (1.73 in)	2
	2	9 mm FMJ	8.0 g 124 gr	426 m/s (1400 ft/s)	4	44 mm (1.73 in)	2
III		7.62 mm (308 Winchester) FMJ	9.7 g 150 gr	838 m/s (2750 ft/s)	6	44 mm (1.73 in)	0
IV		30–60 AP	10.8 g 166 gr	868 m/s (2850 ft/s)	1	44 mm (1.73 in)	0
Special requirement (see sec. 2.27)*		*	*	*	*	44 mm (1.73 in)	*

* These items must be specified by the user.

Notes: Armor parts covering the torso front and torso back, with or without side coverage, shall each be impacted with the indicated number of fair hits. Armor parts covering the groin and coccyx shall each be impacted with three fair hits at 0° angle of incidence. The deformation due to the first fair hit shall be measured to determine compliance. No fair hit bullet or one impacting at a velocity lower than the minimum required bullet velocity shall penetrate the armor.

Abbreviations: AP—Armor Piercing
 FMJ—Full Metal Jacketed
 JSP—Jacketed Soft Point
 LRHV—Long Rifle High Velocity
 RN—Round Nose
 SWC—Semi-Wadcutter

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In addition to the ballistic requirements, the NIJ standard requires quality workmanship and specifies the minimum information that must be included on the armor's label.

The maximum allowable deformation of the clay-backing material was determined through an extensive series of ballistic gelatin measurements and experiments conducted by a team of medical experts. This limit ensures protection from blunt trauma that arises from an impact occurring over vital locations. Even this level of protection, however, does not give an absolute guarantee of protection against internal injuries.

The rationale for the requirement that armor resist bullet penetration is obvious. The reasons for other ballistic requirements may not be apparent.

Wet testing. Certain ballistic fabrics lose ballistic-resistant efficiency when wet, but fully return to normal ballistic efficiency upon drying. Laboratory tests of non-water-repellent treated vests soaked in water have shown a reduction in ballistic efficiency of more than 20 percent compared to that of dry vests. The cause of this phenomenon is not known, but it is theorized that water acts as a lubricant, which allows the bullet to pass through the fibers more easily.

An officer may confront an armed assailant in the rain, and body perspiration can also significantly reduce the ballistic efficiency of untreated fabrics. Laboratory tests conducted by the U.S. Army Natick R&D Command, using a mannequin that simulates human perspiration, verified that vests will absorb perspiration in amounts comparable to a vest that has been allowed to drain following immersion in water. A series of tests was also conducted by a research team from the Department of Justice, in which officers wearing untreated vests were subjected to strenuous exercise on a hot humid day. The amount of perspiration in the vests corresponded to the Natick experiments, and when ballistic tests were conducted a significant reduction in the efficiency was noted. In view of this, the NIJ standard requires that a vest continue to provide the rated level of ballistic protection when wet.

The vast majority of body armor manufactured today uses materials that (1) are inherently waterproof or are treated with water repellants; (2) have a permanent water-repellant covering (such as ripstop nylon); or (3) both. However, the standard requires wet testing to ensure that these vests still provide adequate protection in situations in which they are exposed to moisture.

Those purchasing body armor should be aware that some manufacturers offer models that are supposedly identical in construction to NIJ-tested and -approved models, except that they do not have water-repellant treatment. NIJ considers the removal or alteration of water-repellant treatment to be a change in the design of the vest. NIJ does not, under any circumstances, recognize any model that "partially" complies with the standard.

Angle shots. All Type I through Type III–A body armors are required to resist the penetration of bullets striking at an angle to the surface, because the probability of being hit exactly perpendicular to the surface is low. Certain fabrics are less efficient ballistically by as much as 20 percent when a bullet strikes at an angle. Armor must provide the rated level of protection regardless of the angle of impact.

Performance Testing

As a service to law enforcement and manufacturers, NIJ's body armor compliance testing program tests body armor using independent testing laboratories to determine compliance with the requirements of NIJ Standard-0101.03. The models that comply with the requirements of this NIJ standard are added to its *Police Body Armor Consumer Product List (CPL)*, which is widely distributed to law enforcement agencies as a procurement aid.

Exhibit 4, from NIJ Standard-0101.03, shows the test setup for ballistic testing of police body armor. The chronograph measures the bullet velocity to ensure that each test round is within the range required by the standard. The armor being tested is mounted on a clay-backing material whose consistency is controlled.

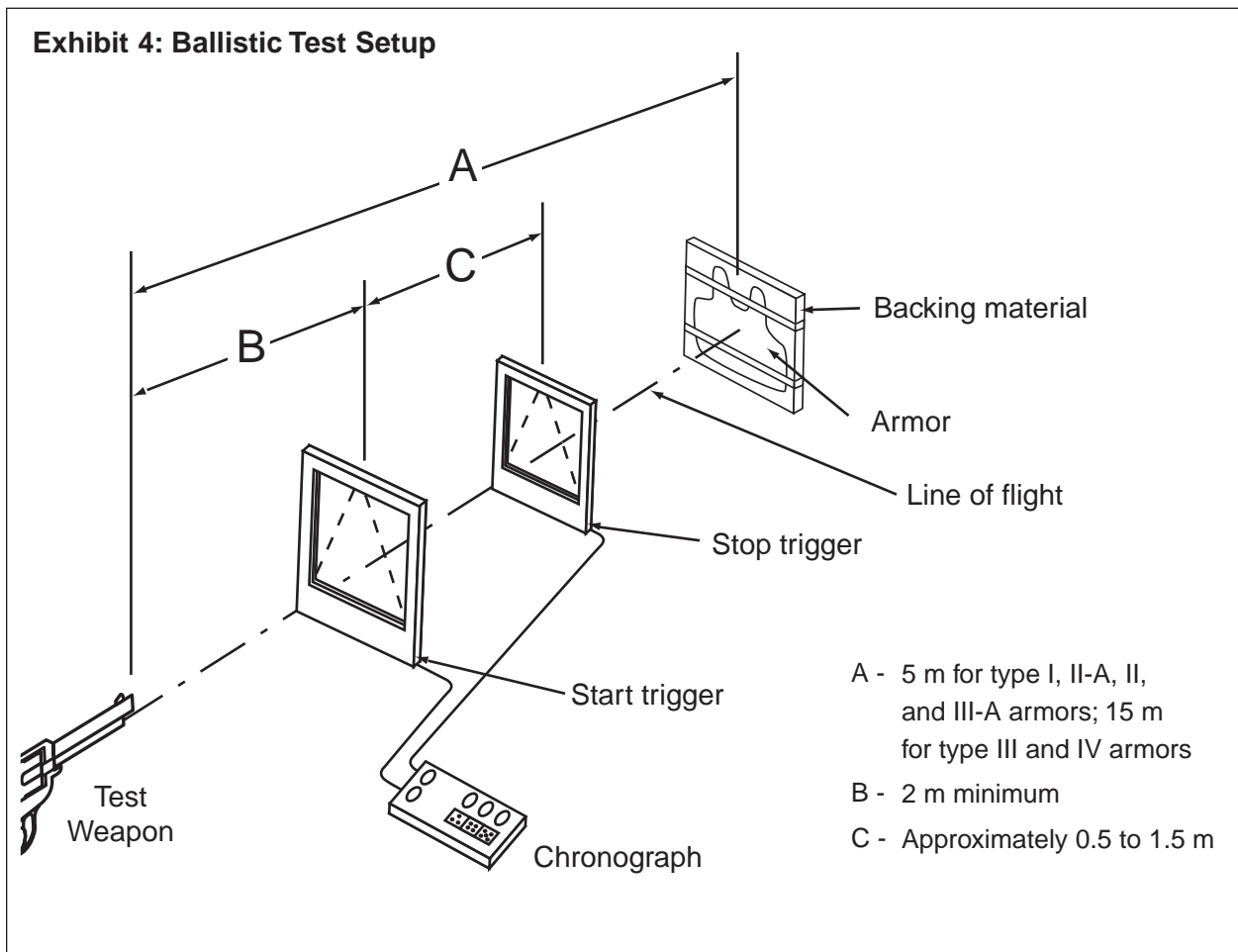
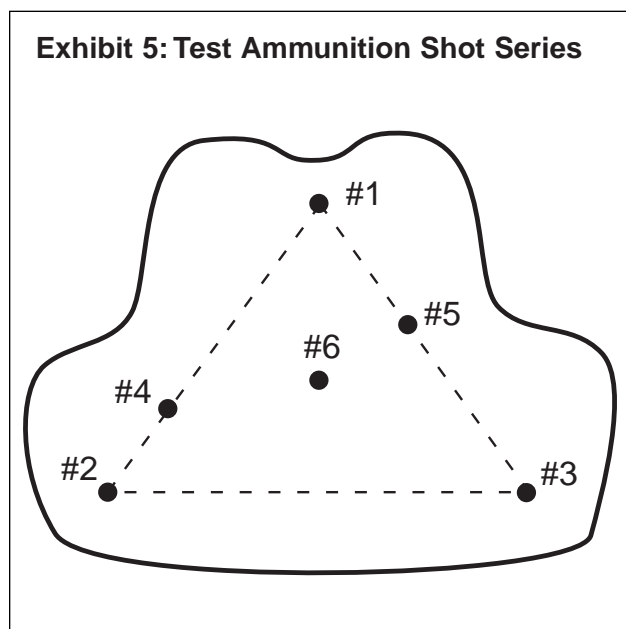


Exhibit 5, also from NIJ Standard–0101.03, shows the general locations of points of impact for each round fired in the six-shot sequence for each type of ammunition specified in exhibit 3 for the type of armor being tested. The deformation of the clay behind the impact of the first shot



(location 1) is measured to determine compliance with the blunt trauma requirement. Following the deformation measurement, the armor is repositioned on the clay and is not smoothed or otherwise disturbed for the remaining five bullet impacts, two of which (locations 5 and 6) are fired at an angle of 30° to the armor surface. The armor is not disturbed during the last five firings in order to evaluate protection from multiple hits.

The armor is tested both while dry and after being sprayed with a measured quantity of water for 3 minutes on each side before being mounted on the clay. Both the front and back of the armor are tested, and, if present, tests are conducted on groin and coccyx (end of spine) protection panels.

The clay-backing material must be properly conditioned and must meet the requirements specified in the standard, as the only current means of relating deformation to blunt trauma protection. Some departments attempt to conduct their own tests using a variety of backing materials, including thick stacks of newspapers, wood, or even steel plates. This practice should be avoided, for the bullet interacts differently with these materials than with the clay-backing material. Furthermore, other backing materials can be unsafe. In several cases, bullets have bounced back and injured the officer shooting at the armor.

V₅₀ Testing

V₅₀ ballistic limit testing is a statistical test developed by the U.S. military to evaluate hard armor of homogenous construction used to protect vehicles. Many body armor manufacturers use a modified form of the military V₅₀ testing as a design tool to develop and assess new body armor designs. V₅₀ testing as used by body armor manufacturers experimentally identifies a velocity at which a specific projectile has a 50-percent chance of penetrating the armor being tested.

In this form of testing, the armor is mounted on the clay-backing material, and specified bullets are fired to determine the velocities at which the bullets do and do not penetrate the armor. A sufficient number of bullets are fired at various velocities to obtain groups of five nonpenetrating bullets and five penetrating bullets, with a velocity range of no more than 38 m/s (125 ft/s)

between the lowest velocity nonpenetrating bullet and the highest velocity penetrating bullet. The V_{50} ballistic limit is calculated as the average velocity of the 10 bullets.

V_{50} ballistic limit testing allows manufacturers to evaluate various designs against one another to optimize their design for a specific type of body armor. A trend has emerged in which manufacturers publish V_{50} test data and also put V_{50} test information on the labels of some of their body armor.

V_{50} ballistic limit testing is a useful and informative statistical tool for evaluating certain characteristics of armor. In addition to being helpful during the design phase of armor development, it may also have the potential for being a valuable tool in evaluating armor's degradation over time. However, it does not evaluate the level of protection afforded against blunt trauma, nor is a uniform standard for V_{50} ballistic limit testing used by all manufacturers. Therefore, it is not suited for use in a performance standard.

ISO 9000

Several armor manufacturers advertise that their companies have obtained ISO 9000 certification. Some confusion exists in the law enforcement community as to what this certification means and its relationship to NIJ compliance testing. The following explains ISO 9000 and its significance to purchasers.

ISO stands for the International Organization for Standardization. Founded in 1946, its charter calls for it to provide harmonized standards for manufacturing quality that are to be used throughout the world. Through the years, ISO's role has expanded beyond the quality system into environmental issues, occupational health and safety, laboratory accreditations, and conformity assessment. Approximately 110 countries participate in ISO standards programs. International standards are prepared through the efforts of technical committees, working groups, and technical advisory groups.

ISO 9000 defines minimum guidelines for **quality management** in the manufacturing process. This voluntary certification process is designed to provide consistency in the manufacturing process that companies use. Companies are required to have a documented quality control system and their employees must follow these established procedures.

The three quality objectives of ISO 9000 are as follows:

- Achieve and sustain the quality of service so as to meet customer requirements consistently.
- Provide assurance to management that intended quality is achieved and sustained.
- Provide assurance to customers that intended quality is being achieved and sustained.

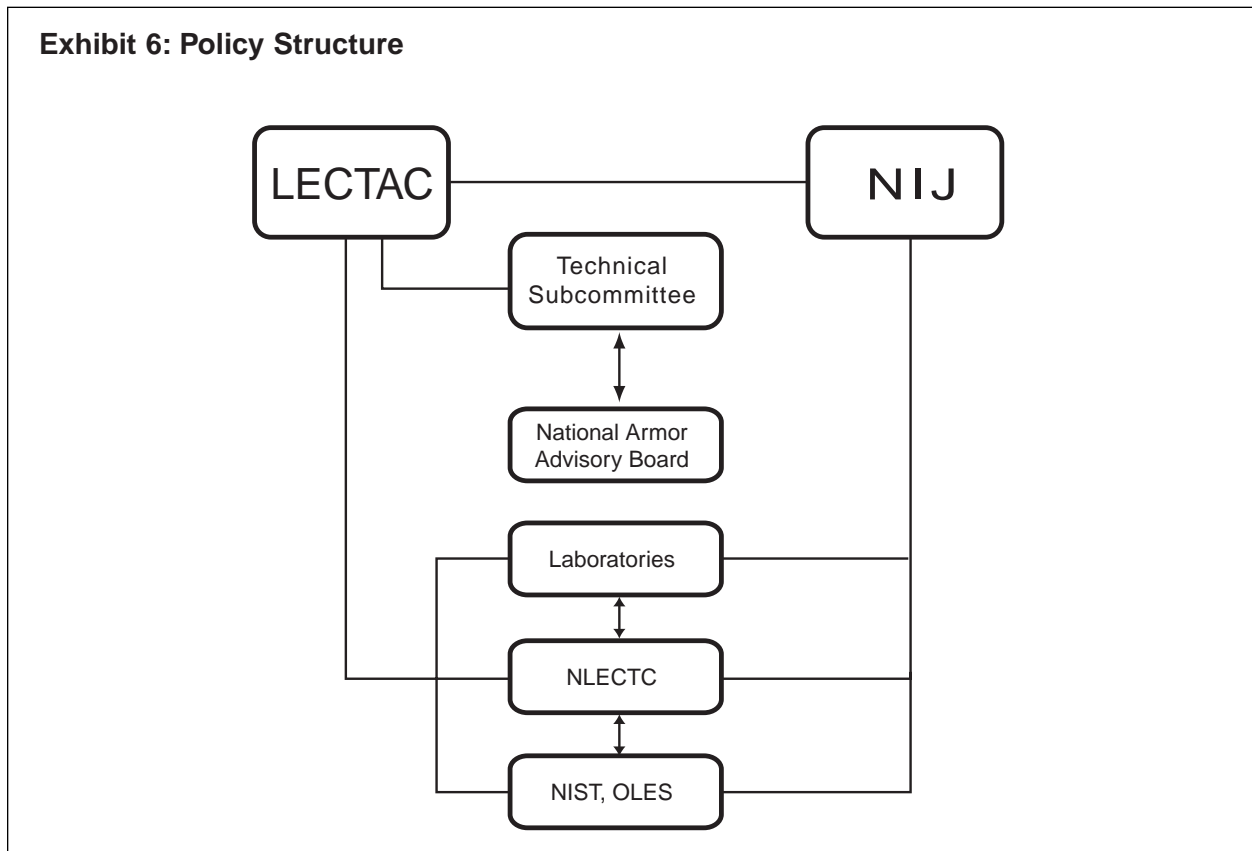
ISO 9000 has three levels of certification. The basic level, ISO 9003, has 16 requirements. The next level, ISO 9002, requires companies to meet all ISO 9003 requirements, plus servicing,

process control, and purchasing requirements. The highest level, ISO 9001, requires companies to meet all the ISO 9002 requirements, as well as documented product design control requirements.

It is important to note that the ISO 9000 certification process certifies the quality control system of companies, not the quality of their products or service. ISO 9000 certification does not imply product conformity to any given set of requirements (such as NIJ Standard-0101.03). Therefore, a clear and significant distinction exists between manufacturers that are ISO certified and whether their products comply with the NIJ standard. ISO certification addresses the quality of the manufacturing process used by armor manufacturers, while the NIJ standard addresses the performance capabilities of specific models of armor produced by manufacturers.

Cooperative Efforts Between NLECTC and Industry

To further enhance its mission to support State and local law enforcement by identifying their needs, finding expedient and cost-effective solutions, and bringing those solutions to the attention of the law enforcement community, NIJ has developed a new cooperative effort between NLECTC and the body armor industry. The existing NLECTC program structure accomplishes this by refining the process for developing policy and by reviewing standards (see exhibit 6).



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Key organizational components of NLECTC's policy development process are NIJ, the Law Enforcement and Corrections Technology Advisory Council (LECTAC), NLECTC, OLES, LECTAC's technical subcommittees, and the testing laboratories. Industry's role has been formalized through the introduction of advisory boards, whose functions are included below.

NIJ. The Institute funds and manages all the activities of NLECTC, resolves disputes and appeals, conducts needs assessments, and coordinates input from the criminal justice system.

LECTAC. A key element in the policy and standards development process, LECTAC is composed of Federal, State, and local law enforcement professionals who are appointed by NLECTC with the approval of the Executive Committee of LECTAC. LECTAC meets at least annually, and its chairperson keeps in close contact with NIJ and NLECTC throughout the year. The advisory council:

- Identifies critical product and technology needs of the law enforcement community.
- Recommends priorities and methods that form the basis from which standards and policies are developed.
- Assesses law enforcement equipment issues, including suggesting research and development priorities.
- Suggests equipment to be tested and recommends the development of guides, bulletins, and other program publications.
- Strengthens links between NIJ and the law enforcement community.

LECTAC subcommittees. LECTAC's subcommittees report to the Advisory Council and meet on an as-needed basis. Subcommittees are formed to address major areas of technology research and development such as law enforcement and corrections operations; weapons and protective systems; communications; and contraband detection, among others. The chair of a subcommittee also serves as or appoints the chair of any advisory board assigned to that subcommittee.

NLECTC. NLECTC coordinates the testing of all equipment under the program and fields requests for information and technical assistance from law enforcement and corrections agencies. The law enforcement and corrections communities look to NLECTC for authoritative information on the latest technology and products. NLECTC also serves as a major source of information on all law enforcement and corrections technologies. NLECTC:

- Coordinates equipment testing activities and collects results from laboratories.
- Publishes Consumer Product Lists (CPLs) of products that comply with NIJ standards.
- Operates a toll-free information service and Internet site.
- Archives tested products.

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- Issues publications on equipment and standards.
- Provides technical assistance to the law enforcement community.
- Serves as a resource to LECTAC and the advisory boards.

OLES. Funded by NIJ through an interagency agreement, OLES is part of NIST. As NIJ's principal agent for setting standards on law enforcement equipment, OLES:

- Conducts technical studies.
- Develops initial standards for testing and provides scientific and technical support to the technical committees and advisory boards.
- Provides technical assistance to criminal justice agencies.
- Evaluates and monitors testing laboratories.

Testing laboratories. Independent testing laboratories are evaluated by OLES and subsequently authorized by NLECTC to conduct testing of manufacturers' products in accordance with NIJ standards; each product is tested before appearing in a *Police Body Armor CPL*. The testing itself is contracted between manufacturer and laboratory, but the equipment must be submitted through NLECTC. Once a performance assurance program has been developed, laboratories selected by NLECTC to test body armor will be required to provide the manufacturers with a followup performance assurance program.

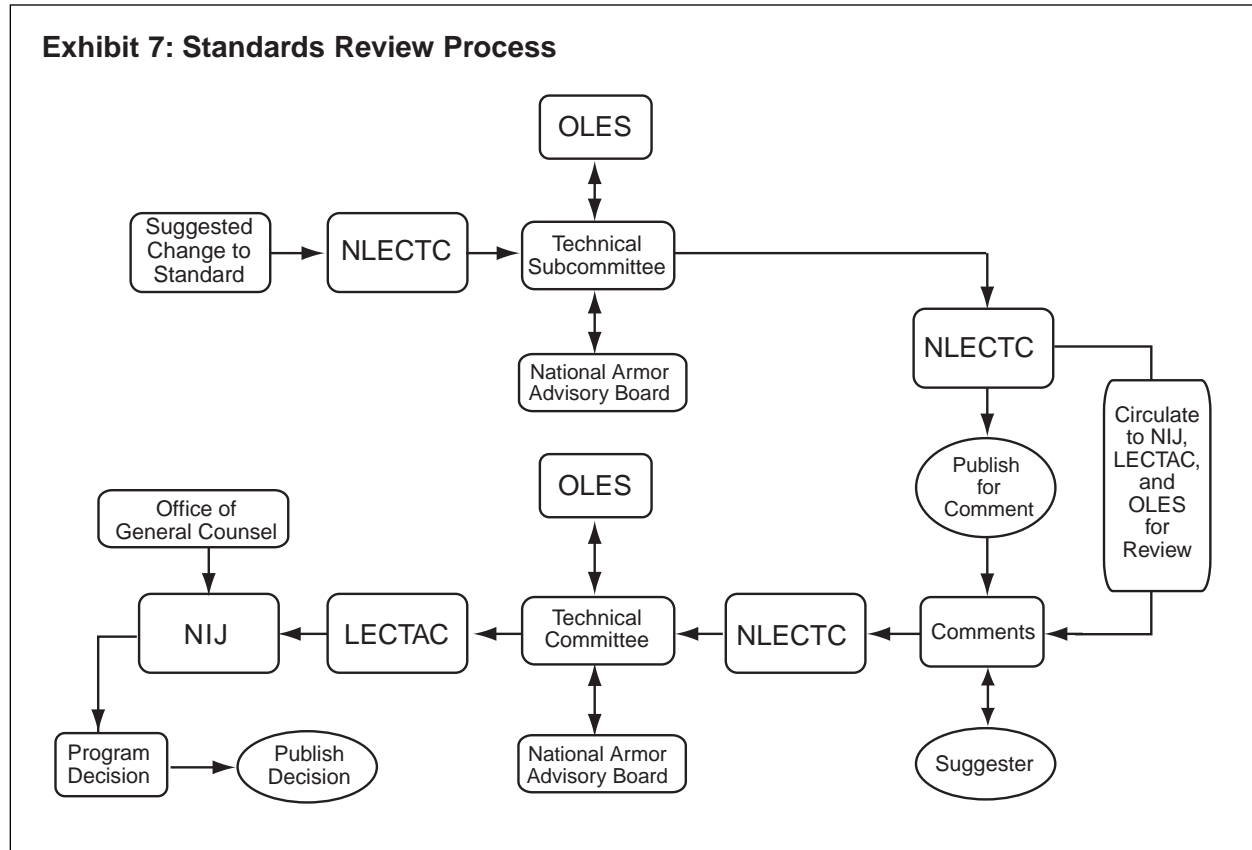
Advisory boards. Composed of industry and user representatives, NLECTC intends to establish advisory boards for each major equipment/technology focus that will report to the respective technical subcommittees of LECTAC. The boards will provide an opportunity for the industry and users to meet directly with LECTAC technical subcommittees. Currently, the National Armor Advisory Board (NAAB) is the only advisory board that has been formed. It is composed of body armor manufacturers, fiber and fabric manufacturers, law enforcement management, and rank-and-file representatives from law enforcement. Board members review standards and policy and recommend revisions to the Weapons and Protective Systems Subcommittee of LECTAC. All advisory boards will recommend actions concerning possible modifications of NIJ standards. If an advisory board endorses a recommendation to their respective subcommittee, it will be referred to LECTAC for its full endorsement.

The Standards Review Process

With advice from NAAB, NLECTC, and the Weapons and Protective Systems Subcommittee of LECTAC, NIJ has formalized a process for accommodating changes to the existing body armor standard. In this revised process, shown in exhibit 7, a suggestion for a change in the standard is

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submitted to NLECTC. NLECTC then conducts an immediate review to ensure that the suggestion is intelligible, relevant to the equipment in question, and has not been considered previously.



If the suggestion passes this review, copies are forwarded to the Weapons and Protective Systems Subcommittee and NAAB. If the suggestion has technical merit and is feasible, the subcommittee directs NLECTC to publish the suggestion and to solicit comments from the field. NLECTC also circulates the suggested change to NIJ, LECTAC, and OLES for review.

Comments from the field regarding the recommendations are provided to NLECTC in a specified number of copies. Copies are also provided by the commenter directly to the person or organization who made the suggestion. NLECTC forwards the comments, along with its recommendations regarding the comments, to NIJ, OLES, the Weapons and Protective System Subcommittee, and NAAB for review. The subcommittee then makes a final recommendation to LECTAC, which passes it on to NIJ. NIJ and the Office of General Counsel review the recommendation to ensure that it fully complies with the law and relevant policy. If it does, NLECTC publishes the decision and the effective date of the change.

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The following options are available to the reviewers when they consider a suggestion:

- Accept the suggestion as offered.
- Accept the suggestion with modifications.
- Refer the suggestion for further research.
- Reject the suggestion because it was improperly submitted, previously rejected, irrelevant, or not feasible.

Suggestions are processed at least annually. If a suggestion is rejected, an explanation is provided. NIJ does not consider revising the standard unless supporting research is presented, nor does NIJ change the standard without comments from law enforcement and the body armor industry. If NIJ errs, it is on the side of the user. The standards review process is similar for other equipment standards.

NIJ's responsiveness to law enforcement and industry concerns is evident in recent changes in the program. These changes include strengthening the program's management and policy structure, creating a process for modifying standards, inviting industry representatives to participate in the standards review process, and sending letters to manufacturers to clarify the responsibilities of those who choose to participate in the body armor program. (This last step is to prevent confusion and misunderstandings that might develop in the use of the NIJ standard and testing program for manufacturers' product advertising and marketing.)

NIJ is proud of the partnership it is forging among government, industry, and the Nation's police and corrections officers. Like all partnerships, the one between NIJ and body armor manufacturers must be based on mutual rights and responsibilities. In return for permission to use the NIJ label, NIJ also asks manufacturers to take responsibility for the safety of their products that are sold to law enforcement officers. Reciprocally, NIJ is committed to working with the manufacturers to adjust the standards and testing program to accommodate the needs and technological advancements of the body armor industry.

6. The Right Protection

Selecting the Appropriate Level of Protection

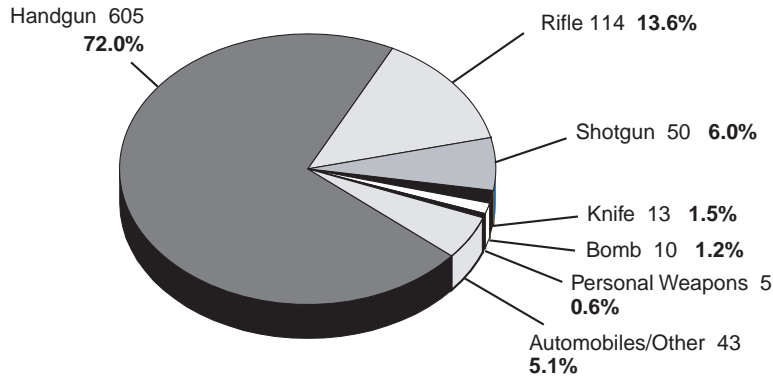
The first step in selecting the appropriate protection level of body armor is to establish the level of protection that users need based on the realistic weapon threat they face. (The six threat levels classified by the National Institute of Justice (NIJ) Standard–0101.03 are detailed in the previous chapter.) To date, body armor has not been known to fail to prevent the penetration of a bullet constituting a threat equal to or less than the protection rating of the armor. However, officers have died from wounds received from weapons or ammunition exceeding the rated protection of the armor. While 100-percent protection in all circumstances is impossible, the routine use of appropriate body armor significantly reduces the likelihood of fatal injury. Body armor selection is to some extent a tradeoff between ballistic protection and wearability. The weight and bulk of body armor are generally proportional to the level of ballistic protection it provides; therefore, comfort decreases as the protection level increases. All departments should strive to select body armor that their officers will wear, consistent with their ballistic protection requirements. Agencies should ensure that each officer knows and understands the protection that it affords, as well as its limitations.

The weapons and ammunition commonly found on the street may vary significantly with geographic location. Therefore, information concerning weapons and ammunition that are confiscated in both the local jurisdiction and nearby surrounding areas must be considered, as well as statistics concerning gun sales by local firearms dealers, such as sporting goods stores. Such data will permit an assessment of the current threat from street weapons. NIJ strongly recommends the selection of an armor that protects against both the street threat and the officer's handgun. A review of reports on officers killed during the period from 1985 to 1996 shows that, on average, one in six officers killed with a handgun was killed with his or her own service weapon.

Information from the Uniform Crime Reports (UCR), *Law Enforcement Officers Killed and Assaulted*¹⁵ provides some insight into the overall threat to officers nationwide. Statistics based on the Federal Bureau of Investigation's (FBI's) UCR data reveal that from 1985 to 1996, 840 law enforcement officers were feloniously killed in the line of duty (see exhibit 8). Of these, 769 (91.5 percent) were killed by firearms—605 (72 percent) by handguns, 114 (13.6 percent) by rifles, 50 (6 percent) by shotguns—and 71 (8.5 percent) by other types of weapons. These other weapons included knives (13 fatalities); bombs (10, 8 of which occurred in a single incident—the bombing of the Alfred P. Murrah Federal Building in Oklahoma City); personal weapons (5); and automobiles and other fatal means not usually thought of as weapons (43).

Of the 605 deaths from handguns, 9mm handguns or lesser handguns were used in 500 (82.6 percent) of the cases.

**Exhibit 8: Law Enforcement Officers Feloniously Killed*
1985–1996**



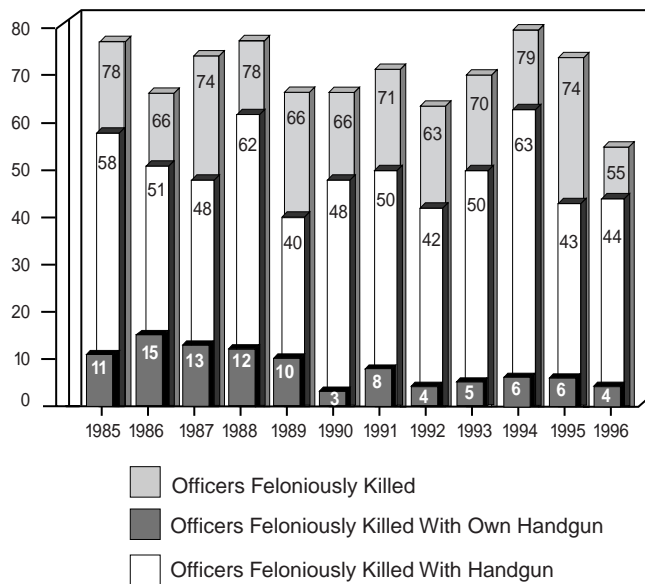
*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted 1996, 1995, 1994*

The “Takeaway” Problem

Another consideration in determining the appropriate threat level is the type of service weapon and ammunition used by the department. In reviewing the UCR data for the same time period (1985 to 1996), a total of 97 deaths, or 16 percent of deaths from handguns, resulted from officers being shot with their own service weapon (see exhibit 9). In these 97 cases, no documented incidents occurred of a round from the officer’s service weapon penetrating the officer’s body armor and causing the fatal injury.

A dramatic decline has occurred in the number of officers slain with their own weapons in the 1990s. For the period from 1985 to 1989, an average of 12.2 officers were slain annually with their own weapons; from 1990 to 1996, the average decreased to 5.1 officers. This decrease can

**Exhibit 9: Officers Slain With Own Firearm*
Versus Total Officers Slain 1985–1996**



*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted 1996, 1995, 1994*

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most likely be attributed to several factors, including increased officer awareness of the problem, expanded use of body armor, enhanced officer safety and weapon retention training, and the emergence of holsters designed with security or anti-takeaway features. However, officers should still be cognizant of the potential danger posed by their own sidearms, should they be used against them. Generally speaking, Type II–A and Type II armor provide protection against most types of handgun ammunition commonly used by law enforcement agencies today.

In analyzing potential weapon threats, a given police department will probably identify several threat levels, depending on the nature of specific assignments. Specialized armor will be required for special weapons and tactics team operations, but these armors will only be issued and used as needed. As noted earlier, armor that provides protection against high-level threats is generally heavy and bulky and therefore can be unsuitable for full-time use.

A department should avoid the temptation to purchase armor that provides protection far in excess of realistic needs. Such a purchase not only increases the cost, but increases the likelihood that the armor will not be worn. Overspecification of protection levels has been alleged as the most common reason that armor is not worn (DuPont study, pg. 12 of this document).

Recognizing that it may not be practical to protect against all possible handgun attacks, a department must carefully consider the selection of armor appropriate to its needs. In the final analysis, those responsible for selecting the level of protection for armor to be used routinely must exercise prudent judgment and decide whether the overall benefits of limited protection (purchasing a less protective armor type than the maximum level of protection indicated by threat analysis) outweigh the complete loss of protection if the armor is not worn.

Armor Styles

Concealable body armor. The most widely used police body armor is the protective undergarment, which is worn under the normal uniform shirt. If properly designed, these garments are relatively comfortable, lightweight, are not unduly restrictive of movement, and are available in a variety of designs.

Typical male and female undergarment body armor garments are designed to provide full front, side, and rear protection. Most undergarment armor uses a hook-and-pile tape fastening system; some older models may feature a “D” ring-fastening system. The ballistic panel is often contained in pouches in a polyester/cotton carrier. When purchasing undergarments of this type, two carriers should be ordered to permit one to be laundered while the other is worn. Metal fasteners should be avoided, for they can become secondary missiles. Hook-and-pile tape fasteners, such as those manufactured by Velcro Corp., should be at least 1½ inches wide and should provide approximately 2 inches of adjustment. In addition, the fasteners should be anchored to a good-quality elastic, approximately 3 inches long, to facilitate proper adjustment and to compensate for body movement.

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The concealed undergarments for female officers should conform to the female anatomy. The seam construction for such garments that include seams is critical. It is very important that the joined pieces overlap each other a minimum of 1 inch. Particular attention should be paid to the length of the garment, which is a frequent problem. The adjustment straps for the female undergarment may be fastened to the back to improve the overall appearance of the uniform.

Many manufacturers market loose-weave undershirts to be worn with body armor. These undershirts may appear to improve airflow over the armor, minimizing heat build-up and perspiration.

Protective undergarments are also available with special pouches that allow additional ballistic protection by inserting armor panels, commonly known as “trauma packs,” in the front and, in some cases, the rear. These panels may be hard, comprised of metal, ceramic, or rigid plastic, or may be soft, made from additional layers of typical vest materials. Note that the increased protection applies only to the portion of the torso behind the insert. Thus far, NIJ has not conducted research to determine the effectiveness of such inserts. In general, NIJ believes that agencies should select armor that provides the rated level of protection over the entire area of coverage, not just isolated areas.

Materials used to construct concealable body armor also permit the design of various other armor configurations, which are sometimes used by police officers assigned to nonuniform duty, such as detective or security details. These include the ballistic-protective sports coats and vests. In addition, raincoats and a variety of jackets, all with ballistic liners, are available. Officers can even purchase shirts with ballistic protection. Even more casual appearing protective vests, such as a simulated down outer vest and a denim work jacket, are on the market. Numerous designs of tactical protective vests are also available. All these styles of body armor can meet the requirements for NIJ Standard–0101.03.

Semirigid body armor. Body armor that provides protection against higher threat levels (III and IV), as specified in NIJ Standard–0101.03, will be of either semirigid or rigid construction. Semirigid armor can consist of a somewhat flexible material with impregnated ballistic fabrics or a garment composed of small articulated plates of ballistic material such as steel, ceramic, or plastic, reinforced with some type of woven ballistic material. This design borrows from the naturally occurring armor design of the armadillo. Semirigid vests are difficult to conceal and allow the use of dense materials (high areal density), while retaining limited movement.

Rigid body armor. Rigid body armor is composed of molded ballistic material, designed to cover certain portions of the body. Rigid body armor is perhaps the most restrictive of body movement and is also difficult to conceal. A typical tactical vest incorporates a panel of rigid armor into a typical concealable armor vest and is worn externally. In general, semirigid and rigid body armors are used only for short periods when expecting confrontation with high-level threats. Users should carefully review the labels of rigid armor to determine if it offers single-shot or multihit capability.

Comfort and Fit

When selecting armor for full-time routine use by an officer, comfort is a major factor. Armor that is set aside or relegated to the trunk of a cruiser is of no benefit. The NIJ development effort recognized this “real world” problem and therefore emphasized comfort in the design of lightweight body armor for police use. Two fundamental factors were considered: fit—from the standpoint of mobility and the weight distribution of the armor—and heat discomfort. Both these armor characteristics were evaluated by the U.S. Army Natick R&D Command, using instrumented anatomical models of the human body. The weight-distribution measurements led to an improved design for the garments. Similarly, the dissipation of body heat through body armor was measured. Those tests demonstrated that, during normal activities, an individual wearing body armor would not suffer unduly from reduced dissipation of body heat. For example, the long-sleeved police uniform has roughly the same heat dissipation as utility army fatigues. Adding the original NIJ vest to the police uniform prevented about the same amount of heat loss as adding a liner to an army fatigue helmet.

Comfort, with respect either to fit or to heat dissipation, is at best subjective and a matter of individual sensation. However, adequate case history and field experience exist to indicate that body armor is suitable for full-time use and that an officer should accept minor discomfort in exchange for the protection that is afforded. To resolve questions concerning comfort, a few members of the department might wear samples of armor on a trial basis before the department makes a major purchase.

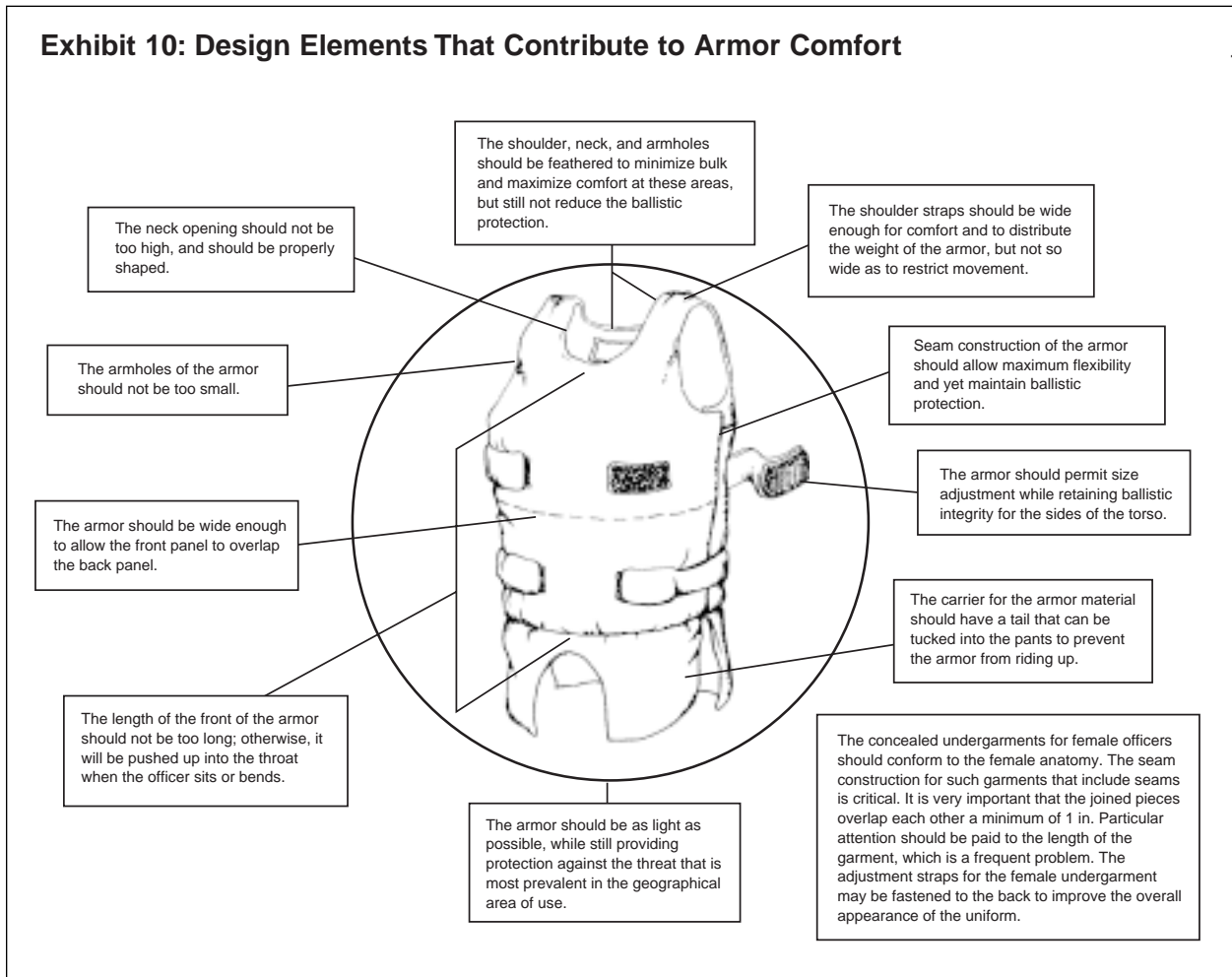
The introduction of several new fabrics used to make the permanent protective cover for the ballistic element and the removable outershell carrier have greatly enhanced the comfort and wearability of body armor. GoreTex[®], a fabric made of expanded Teflon[®], is a water-resistant fabric that, according to the manufacturer, allows perspiration to evaporate but prevents moisture from reaching the ballistic material. By using GoreTex[®], some manufacturers have eliminated the water-repellent treatment on the ballistic material, which they claim improves the “breathability” of the vest.

CoolMax[®], a fabric originally developed for use in athletic apparel, is now being used by some manufacturers in place of traditional cotton and nylon fabric in manufacturing the removable outershell carrier of the vest. According to the manufacturer, CoolMax[®] acts like a wick, drawing perspiration away from the body to the outer surface of the garment, where it can more easily evaporate.

Laboratory tests and comments from officers who wear body armor during their daily shifts have identified a number of factors that bear on the comfort of body armor when worn for extended periods of time. See exhibit 10 for a listing of factors to consider when evaluating armor.

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Exhibit 10: Design Elements That Contribute to Armor Comfort

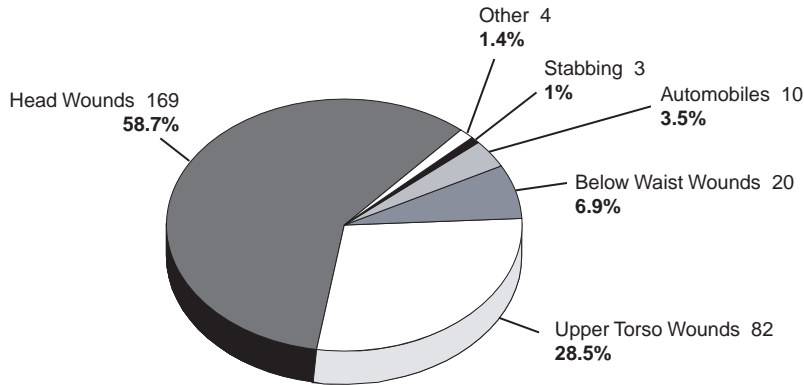


Coverage

It is possible to purchase armor that covers only the front torso, with a separate section that can be added to protect the rear torso and the sides. An officer who spends nearly the entire duty shift in a vehicle may be tempted to wear only chest protection, but this is not advisable.

Statistics bear grim testimony to the importance of using armor that provides full coverage. According to the UCR data from the period 1985 to 1996, 288 law enforcement officers were killed while wearing protective armor (see exhibit 11). Of those officers 169 (58.7 percent) were killed by gunshot wounds to the head; 82 (28.5 percent) died as a result of gunshot wounds to the upper torso; 20 (6.9 percent) died as a result of gunshot wounds below the waist; 10 (3.5 percent) were struck by automobiles; 3 (1 percent) were stabbed; and 4 (1.4 percent) died by other means.

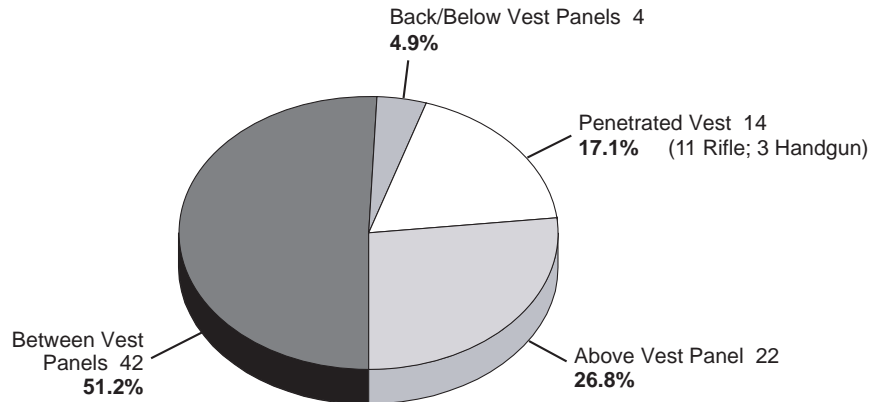
**Exhibit 11: Officers Killed Wearing Protective Armor
Causes of Death* 1985–1996**



*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted 1996, 1995, 1994*

Of the 82 officers killed by gunshot wounds to the upper torso, 42 (51.2 percent) were killed when the round entered the torso region between the panels of the vest or through the arm openings, and 22 (26.8 percent) were killed when the round landed above the coverage area of the vest (see exhibit 12). Therefore, a vest must provide full front, side, and back protection with the wrap-around portion going from front to back. Proper fit is equally important for ensuring adequate coverage and protection. Ideally, officers should be individually measured and fitted for concealable body armor. Because a large weight gain or loss can have an adverse impact on proper fit, armor should also be inspected routinely to ensure proper fit. Improperly fitting armor needs to be brought to a supervisor’s attention immediately for corrective action.

**Exhibit 12: Upper Torso Deaths*
Location of Rounds 1985–1996**



*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted 1996, 1995, 1994*

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Fourteen of the 82 officers killed by gunshot wounds to the upper torso died as a result of rounds penetrating the body armor. Of these 14 incidents, 11 were the reported result of rifle rounds, which the armor was not designed to protect against. The other three were the result of handgun ammunition. However, in only one of these cases was it confirmed that a round fired from a handgun actually penetrated the armor. In this case, the officer was wearing a vest that provided front-only protection; the penetrating round exceeded the protection capabilities of the vest and the second, fatal round impacted an area not protected by the vest. **No documented fatal injury has ever resulted from a round of ammunition penetrating body armor that NIJ had approved as protection against that level of threat.**

7. Purchasing Body Armor

Overview

Before purchasing body armor, a police department must first assess its potential ballistic threats and determine what level of protection is required for its officers. (This process is discussed in chapter 6 of this guide.) Only after determining the protection needs of the department should those responsible for purchasing body armor begin to review specific products. Next, the department should select several models, preferably from several different manufacturers, from the *Police Body Armor Consumer Product List (CPL)* that meet the department's protection needs. This document, published through the National Law Enforcement and Corrections Technology Center (NLECTC), provides a listing of the models of armor that have been tested and found to comply with *Ballistic Resistance of Body Armor; NIJ Standard-0101.03*, which independently validates the manufacturer's claims regarding the performance characteristics of the vest.

The next step is to solicit competitive bids from the companies (or company representatives) that manufacture these models and to choose a model (usually the most cost-effective option). And when the armor arrives, the purchaser should verify that the armor received is the specific model that was ordered.

At a glance, purchasing body armor may seem like a relatively simple process. However, complications sometimes arise from various sources that make the purchasing process much more involved. Two of the principal problems that can complicate the purchasing process are obtaining objective information from salespeople and the tendency to overspecify departmental needs through the departmental procurement process.

A salesperson's goal is to persuade a department that his or her product is the best available. Sometimes, a salesperson will suggest a department include requirements unique to his or her company's product in purchase specifications. Also, some manufacturers use product demonstrations that are designed to show that their armor is superior to that of competitors. Departments should be cautious of these practices. Basing purchasing decisions on NIJ Standard-0101.03 and the *Police Body Armor CPL* can help departments avoid the problems caused by the use of a single manufacturer's construction and/or design specifications. These problems include paying higher rates if the specifications limit competition to a single source or purchasing armor that may not meet department needs.

Police departments often handle armor procurement as a committee action. This approach can result in overspecification of department needs, caused by trying to satisfy all of the committee members by including each member's personal preferences in the product specifications. A more efficient approach is to assign the task to two or three officers, provide resources to help them familiarize themselves with armor technology, and allow them to independently assess the department's needs. The officers should then make a decision, informing the department's administration, justifying their selection, and being prepared to demonstrate why their choice represents the needs of the majority of officers.

The Procurement Process

Typically in the procurement process, an agency or department develops requirements, solicits bids, reviews bids and submitted samples, and then awards the contract to the bidder that best meets the price and product specifications.

Generally, armor purchases fall into one of four categories:

- Individual purchases from a distributor or retail outlet.
- Small-quantity departmental purchases.
- Large-quantity departmental purchases (several hundred units or more).
- As-needed purchases procured through an open-ended agreement (also called a term contract).

Individual or small-quantity purchases can be best described as “what you see is what you get.” Large-quantity purchases should be made only through a competitive process involving several bids from the manufacturers that produce the models meeting the department’s protective needs.

NIJ Standard–0101.03 focuses on the ballistic protection characteristics of body armor, and the *Police Body Armor CPL* presents the models that meet the requirements of the standard. Departments that base their purchases on the *Police Body Armor CPL* need to specify in the purchase agreement any additional features they require, as determined during the needs assessment phase, such as color or area of coverage.

Procurement of law enforcement equipment should always focus on the following areas:

- Clarity (ensuring that the purchase agreement is not ambiguous in any way).
- Simplicity (including only items essential to the purchase agreement).
- Internal consistency (ensuring that requirements for each individual item do not conflict with one another).

To ensure that bids involve only armor in compliance with NIJ Standard–0101.03, a typical purchase agreement might include the following wording:

The body armor model shall be tested by NLECTC and found to comply with all requirements of NIJ Standard–0101.03 [or current edition if a new revision is available], *Ballistic Resistance of Police Body Armor*, dated April 1987. It shall be of Type (specify appropriate threat level and test ammunitions), as defined in that standard, and shall afford full protection to the torso front, torso back, and sides.

A purchaser needing special ballistic protection that would require additional testing should specify the exact test rounds to be used (listing such variables as caliber, bullet shape, bullet mass, configuration, and velocity) and state that NIJ Standard–0101.03 will govern in other

respects. When additional testing is needed, the police department should place reasonable time demands on the manufacturers.

A department developing a purchase agreement should be aware of two issues that may complicate the procurement process. The first, mentioned earlier in this chapter, is to describe a particular product in the product specifications section of the solicitation for bids, which would eliminate the chance of a truly competitive process. Instead, the department should consider requesting bids for armor that complies with NIJ Standard–0101.03 and then add specific, nonballistic features only if essential. The second issue is the requirement that the department accept the lowest bid. Instead, the department should consider adding a clause in the bid solicitation that allows the agency to buy from the manufacturer offering the armor that best meets the department’s needs and that the officers find most comfortable.

Ensuring Compliance Status

Just as a department should not purchase a model of armor that has not been tested by NLECTC or does not comply with NIJ Standard–0101.03, a department also should not accept statements—written in the bid or verbally made by a salesperson—that the model shown is “just like” or “identical to” a model from the *Police Body Armor CPL*. Instead, those responsible for procurement should ensure that the armor model designation on the ballistic panel label is identical to the one listed in the *Police Body Armor CPL* and should receive proof (a copy of the compliance letter issued by NLECTC to the manufacturer for that model) that the armor is in compliance with NIJ Standard–0101.03. If the supplier or bidder cannot provide these two items, the department should use another supplier. If a department still has questions about the compliance status of a particular model, they should contact NLECTC at 800–248–2742 or 301–519–5060.

Model Procurement Specifications

Major purchases of armor give departments the chance to specify exactly what features they want included in the product design that will provide for officers’ body armor needs. Also, each jurisdiction is subject to departmental procurement terms and must add specifications to the solicitation and purchase agreement as required by these terms. For instance, Federal procurements often include a clause requiring that the items purchased be manufactured in the United States; other jurisdictions may require preference be given to small businesses or local manufacturers. Such contract conditions are often written in wording standard to all departmental purchasing orders and then inserted in appropriate sections of each bid package. Yet, departments should remember that overspecification can complicate the procurement process by making it difficult for a department to find a product that meets all of the specifications.

Documents related to the procurement of body armor should include certain items. The issues discussed in the remainder of this chapter apply to the specifications section of purchase orders

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and assume that the department has previously assessed its officers' protection needs and determined the appropriate type of armor, as specified in NIJ Standard-0101.03. Departments should not include requirements that are unreasonable or technically impossible to achieve.

The following guide to procurement specifications assumes the department has selected a specific type of armor from a single manufacturer that provides the needed protection level. (Appendix D provides an example of the procurement specifications section of a purchase agreement solicitation.) Negotiating an open-ended agreement (term contract) for multiple models, styles, and armor types from a single manufacturer involves a separate set of issues.

Terms of agreement. Whether a department purchases armor in a single quantity (buying one unit at a time or a quantity at one time), through a blanket purchase agreement, or under a term contract, the bidder must know how many units will be purchased, including the number of vests for female officers. Under a blanket purchase agreement, an agency can purchase units "as needed" during the life of the contract. No matter which approach is used, a department may want to include a clause for ordering additional units, which would make future purchases simpler because new bids would not be required.

Prebid conference. When purchasing a large quantity of armor or considering a blanket purchase agreement, a department may want to arrange a prebid conference between it and prospective bidders. Bidders and the department can then review the solicitation as well as the department's specifications, so that all parties clearly understand the department's needs. Also, a prebid conference may reveal any ambiguous or contradictory terms or requirements in the solicitation. If the solicitation needs to be modified, the department can issue an addendum.

Bidding and award process. The clauses in procurement packages should be self-explanatory and furnish adequate flexibility in purchasing the armor considered most appropriate for the department. Again, the *Police Body Armor CPL* should be the main resource for departments. In the bid, the manufacturer should identify the specific model it proposes to provide. Moreover, the final purchase agreement, if other than the bid solicitation package, must specify the model selected.

Invoicing and delivery. This section of the package should propose a detailed delivery schedule and should specify departmental invoicing and payment regulations and procedures.

Warranty and insurance. These clauses clarify the warranty on the purchased units. Here the department must specify the amount of product liability insurance required based on its needs or on the options available from the manufacturer. Product liability insurance can be expensive; a department should consult with counsel about liability insurance's benefits to the department before including an insurance clause.

Armor specifications. This section is the focal point of a procurement program, because here the department delineates the protection performance it expects of the armor to be purchased as well as departmental preferences about design and configuration. (See appendix D.)

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- **Item A—NIJ Standard–0101.03 requirements.** Citing the ballistic performance required by specifying the appropriate armor type, as defined by NIJ Standard–0101.03, is a mandatory component of the specifications section. This information ensures that the armor ordered provides a known performance level.
- **Item B—Labeling.** The label included on the ballistic element is another critical item, as it alerts the wearer to how limited the protection provided is. It also states that the individual unit complies with NIJ Standard–0101.03. If the unit does not perform as stated on the label, a department may have the right to legal recourse.

Inclusion of the manufacturer’s model number on the ballistic panel label is also important because it is the primary means for verifying that the armor received is that ordered and that the compliance matches the armor type listed on the purchase order. In past cases reviewed by NLECTC, armor has been labeled with an incorrect (i.e., providing a lower level of protection than that ordered) ballistic element in a model rated for a higher level of protection.

A manufacturer or distributor may use catalog numbers or similar designations to further identify the product if the armor is properly identified as a specific model in compliance with NIJ Standard–0101.03. The catalog number must be separate from the model or style number. Meanwhile, the model number should be unique and the same as the model number tested by NLECTC.

Again, it is important that departments purchase only models that have been tested by NLECTC and found to comply with NIJ Standard–0101.03. By doing so, if there ever is any question about an individual unit’s configuration or construction, the armor can be compared with the unit of that particular model that was originally tested by NLECTC, which NLECTC retains in archival storage.

- **Item C—Configuration.** Specifying a particular configuration of ballistic elements in a particular carrier is essential if the department believes that only one type of configuration will meet the department’s needs. A department that wants to explore its configuration options may not want to include such a statement.

Manufacturers sometimes use ballistic elements that were tested and found to comply with NIJ Standard–0101.03 in more than one configuration. For instance, a ballistic element may have been tested in a configuration with an open, unprotected area on the side of the torso; an identical ballistic element may also be manufactured with the sides extended to create an overlapping configuration. These two would be considered as separate styles of the same model.

- **Item D—Adjustment options.** This clause identifies design features that will make the armor more comfortable for the wearer. However, this clause may not apply to tactical armor or other armor configurations worn outside of clothing.

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- **Item E—“Riding up.”** Wearing armor for long periods of time can cause the armor to move up on the wearer’s body, which decreases the officer’s comfort. This clause applies only to concealable armor and may not be necessary if the adjustments in Item D are completed.
- **Item F—Metals.** Departments should carefully evaluate purchasing armor that includes any metal components, as the wearer may be injured if a bullet strikes the metal part and ricochets, or if a piece of the metal component breaks off and becomes a secondary projectile.
- **Item G—Color.** To ensure that the armor is properly concealed, it is important for departments to choose a color that will not be visible through the wearer’s uniform.
- **Item H—Quality.** This clause ensures that the manufacturer will produce the armor using suitable materials and a high workmanship quality in producing the units.

Departments should not include any specifications that are unique to one manufacturer’s product so as not to reduce their available options to a single model. Likewise, they should not try to dictate how the ballistic element used in the armor is constructed. For instance, a department should never specify a specific fabric or weave for the ballistic material, nor should it specify the number of layers of material to be used in the ballistic element. Doing so could restrict the bid to a single manufacturer, result in armor that does not meet the requirements of NIJ Standard–0101.03, or create conflicting requirements, in which case the manufacturer could be released from liability if the armor does not perform properly. In addition, departments should not name a maximum weight, which could mean that officers would not receive the needed ballistic protection because the required type of armor weighed more than the specified limit.

Departments should also include in the procurement specifications any features identified as essential in the needs assessment phase. For instance, some departments have required that armor be designed so that the front and back panels cannot be worn separately, to prevent officers from wearing only the front part of the armor. Other departments require that concealable armor be supplied with two carriers, so that one can be laundered while the other is in use. Regarding armor configuration, NIJ recommends that armor provide side protection for full torso coverage. Overlapping the front and back panels by at least 1 inch—preferably 2 inches—will accomplish this. NIJ suggests that when overlapping the two panels, the front panel should overlap the back panel to prevent a round from “skipping” between the two panels.

If the department wants each officer’s armor to be custom fitted, the specifications section should include a clause to that effect, stating how and where fittings will take place. Also, labeling specifications should require that the name of the officer be printed on the armor label.

A number of other items can be included in the procurement specifications, such as requiring that the armor use nonmetallic “D” rings or hook-and-pile fasteners, but NIJ does not recommend this practice. Items of personal preference are best addressed when departments are inspecting the manufacturers’ samples and evaluating them for comfort. In addition, prospective buyers should remember that specifying a number of required design characteristics increases

the chance that the armor will become a custom or nonstandard design, which could require additional testing to ensure compliance with NIJ Standard–0101.03.

Items to be submitted with the bid. This section—a listing of the required items to be included in the bid package—should be self-explanatory to bidders. Because each department is subject to a particular set of procurement regulations, additional clauses addressing these requirements will most likely be necessary.

Termination of agreement. A clause that specifies the conditions under which the department can terminate the contract must be included in any procurement documents. If a department is purchasing through a blanket agreement or term contract, it may want to include a “for the convenience of the department,” 30-day, written-notice clause allowing the department to cancel the agreement if officers find the armor received—even though in full compliance with the procurement specifications—to be unacceptable.

Another justifiable reason for breaking the contract is if the armor is not delivered according to the predetermined shipping schedule, in which case the department should be allowed to cancel the contract and begin legal proceedings for default. Receiving a substandard product should also justify canceling the contract. When listing the product specifications, a department must be sure to define the reasons why the product may be rejected and the contract terminated. For instance, poor workmanship is a legitimate cause for rejection, but may be difficult to objectively establish unless previously defined in the purchase agreement.

Acceptance testing. Ballistic-resistant materials, like components of any other product, may vary among the manufacturer’s lots of production material. For this reason, the material used to produce the armor purchased may not perform as well as that used to produce the samples tested by NLECTC. Therefore, some departments purchasing large quantities of armor include requirements for acceptance testing in their procurement specifications to ensure that the armor purchased complies with NIJ Standard–0101.03 even though the model is listed in the *Police Body Armor CPL* as in compliance. If acceptance testing is to be included, the manufacturer and the department must agree on the testing and associated costs.

Obviously, substandard ballistic performance is the central concern for police departments and is a primary reason why contracts are canceled. Ballistic performance can only be determined by testing that will destroy the armor. Furthermore, to verify each model’s full compliance with NIJ Standard–0101.03, a minimum of four sets of armor must be tested. This full test currently costs approximately \$1,500, not including the price of the vests used in the testing.

When the \$1,500 (plus armor) cost of testing is amortized over 100 vests that are represented by the armor being tested, the per vest cost is approximately \$30. If every unit of armor purchased was manufactured from the same lot of ballistic material, a single set of tests would be required. However, if the armor purchased has been constructed from two or more production lots, NIJ suggests that samples from each lot be tested. It is important to note that each additional production lot used will significantly increase these testing costs.

A department wanting to use acceptance testing must address it in its procurement package, noting that testing will be conducted once the purchase is delivered and that if the armor fails to comply with NIJ Standard–0101.03 the armor will be rejected and returned and the contract will be terminated. The procurement package must also identify who will pay for the armor to be returned—the department or the manufacturer.

In-service testing. Another testing-related issue stems from the fact that the armor must continue to meet the requirements of NIJ Standard–0101.03 while the armor is under the manufacturer’s warranty. DuPont, for instance, suggests that police departments inspect and test their armor after 3 to 5 years of use, based on the company’s belief that the ballistic performance of armor manufactured from Kevlar® can be reduced through use and abuse.¹⁶ In addition, some departments have, on their own initiative, implemented annual inspection and testing programs independent of those required for warranty purposes.

One must ask: Who pays for this testing, and what happens if testing reveals that the armor does not comply with NIJ Standard–0101.03? Large departments usually can absorb armor testing costs into their equipment maintenance budget. Departments planning to conduct annual testing of armor should note this in the procurement package and should identify the funding source.

The answer to the second question—what happens if the armor fails to comply with NIJ Standard–0101.03—depends on the purchase agreement. According to NLECTC, one department stated in its bid package that if armor in service is tested and does not comply with the NIJ standard, the manufacturer will refund the annual prorated value of the product for the remaining warranty period. For example, the manufacturer would refund 20 percent of the purchase price for each remaining year of a 5-year warranty ($100 \text{ percent} \div 5 \text{ years} = 20 \text{ percent per year}$). The same bid package also states that the department will return all of the armor to the manufacturer. Another approach is for the manufacturer to provide a credit to the department toward the purchase of replacement armor, prorated according to a formula similar to that listed above.

Protection/Testing Considerations

Although body armor for routine, full-time wear has been available for approximately 20 years, the current technology is relatively new and continues to change. For instance, manufacturers once used almost exclusively a single type of fabric in constructing concealable body armor. Today, at least five different types of fiber are used to manufacture ballistic-resistant fabric, each of which is available in a variety of woven and nonwoven fabrics and panels. The ballistic protection properties differ among materials and often two or more types of fabrics or composites are used in combination to manufacture a vest. Because of these complexities, a department should not attempt to dictate how the ballistic element will be constructed, such as by specifying the number or types of layers of ballistic material. Armor performance is the critical issue, not the manufacturer’s construction of the armor.

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Acceptance testing should be performed whenever a large-quantity purchase is received. However, NIJ does not consider this guiding rule to apply to blanket purchase agreements and term contracts, because manufacturers may produce individual purchase orders from several lots of material. In these cases, a department may want to carry out limited testing periodically, but, to test armor from each production lot would be expensive and impractical. Again, the manufacturer and the purchaser must address in the contract what will happen if any of the armor fails to comply with NIJ Standard-0101.03. For instance, the manufacturer might agree to replace any armor manufactured from the lot of ballistic material that failed testing. In addition, a department may want to test previously purchased armor that was manufactured from material lots not included in prior screening tests. To accurately assess its testing alternatives, a department must consider the structure of its blanket purchase agreement or term contract.

A department can accurately estimate testing costs only if it knows how many tests will need to be conducted. Thus, a department that requires acceptance testing—especially for small-quantity purchases—may want to include in its contract a clause limiting the number of lots of ballistic material that will be used to manufacture the armor to a few lots or even one. Testing costs are either directly paid by the department or absorbed into the manufacturer's unit cost. Indirect costs associated with acceptance testing and later service-life testing include administrative paperwork, time for analyzing the results, and travel, if the department wants a representative to witness the ballistic testing.

Police departments often include armor testing costs and departmental travel as manufacturer-related expenses, which are part of the bid price. However, NIJ does not recommend this practice because the public served by a department might doubt the propriety of an officer who accepts travel expenses from the manufacturer when the performance of armor purchased is in question. Instead, NIJ suggests that the department separately budget for armor testing and contract directly with a NLECTC-approved laboratory. This provides a clearer picture of the armor purchase price per unit and provides the department with more flexibility in its testing program.

Finally, a department that elects to conduct acceptance or service-life testing must remember to order an adequate number of additional sets of armor to be used for testing.

8. Maintaining Body Armor

The proper care of today's modern body armor requires taking precautions when cleaning the garment. Every model of armor that complies with *Ballistic Resistance of Police Body Armor: NIJ Standard-0101.03* has an instruction label indicating how to clean the components. Individuals should follow these instructions, making certain that anyone else who cares for the garment is also aware of correct cleaning procedures.

The ballistic panels, or inserts, of body armor should be washed by hand with cold water using a sponge or soft cloth and mild home laundry detergent. Most manufacturers strongly recommend that the ballistic panel never be submerged in water. Bleach (including nonchlorine or peroxide-based bleach) or starch, even when highly diluted, should not be used as these may reduce the garment's level of ballistic resistance. If a model of armor has a removable carrier, it is possible that the carrier may be machine washable. However, it is imperative to follow the manufacturer's care instructions found on the ballistic panel and carrier labels.

Body armor panels or inserts are not to be machine washed or dried, either in the home or commercially. The fabric can be damaged by laundry equipment, ultimately affecting its ballistic performance. Commercial laundries also use commercial detergents, which are much harsher than home detergents, and pose another threat to maintaining the ballistic-resistant properties of the fabric. According to DuPont, perchlorethylene is the only drycleaning solvent found so far that does not significantly degrade the ballistic protection provided by current body armor.¹⁷ However, to eliminate the possibility of an accident and avoid the variety of drycleaning solvents in use, drycleaning armor is not recommended.

Most modern body armor contains water-repellant treated or inherently water-repellant fabrics, making hand washing possible by preventing the water used to wash the vest from degrading the ballistic capabilities of the vest. However, rinsing thoroughly is still important to remove all traces of soap. Rinsing properly prohibits the accumulation of residual soap film, which can absorb water and reduce the ballistic resistance of certain types of ballistic fabric.

Body armor fabric should never be dried outdoors, even in the shade, as ultraviolet light is known to cause degradation of certain types of ballistic fabric. Tests have demonstrated that ballistic efficiency is significantly and adversely affected by exposure to sunlight for extended periods of time.

Each time body armor is washed, it should be inspected for any signs of wear. If the ballistic fabric is not covered with a permanent cover, and it appears that the thread used to sew layers together is wearing badly or that the fabric is unraveling, the vest should be returned to the manufacturer for replacement. Officers should never attempt to repair armor themselves under any circumstances.

Today, most manufacturers market concealable body armor with the ballistic panel sealed within a moisture barrier, such as thin rip-stop nylon or coated cloth, instead of chemically

waterproofing the fabric. The owner of such armor must routinely inspect it to be sure that the cover of the ballistic inserts has not been cut or damaged, which would allow moisture to penetrate the ballistic panel. Even if the outer covers have not been cut or otherwise damaged, the moisture barrier can still be damaged. When the ballistic material or the outershell carrier rubs over the ballistic panel cover as a result of the normal flexing that occurs when body armor is in use, it can wear through the cover and expose the armor to moisture penetration. It should also be noted that certain types of covering materials tend to make the armor much warmer to wear, because it significantly reduces the rate at which perspiration can evaporate or be absorbed.

The exceptional ballistic efficiency of materials used to construct body armor compensates for any of these limitations associated with maintenance and care. The user can easily care for and properly maintain body armor and ensure that it provides its rated protection throughout its service life.

When caring for hard armor, it is important to remember that hard body armor, particularly ceramic material, must be handled carefully because it is fragile. Ceramic materials—such as boron carbide, aluminum oxide, or silicon carbide—are extremely brittle. Such armor should not be dropped on hard surfaces and, when used, the ceramic must serve as the striking (exterior) surface. It should also be inspected before each use to ensure that no surface cracks are present that would degrade ballistic performance.

9. Body Armor Life Expectancy

One of the most frequently asked questions the National Law Enforcement and Corrections Technology Center (NLECTC) receives is, “How long does body armor last?” Unfortunately, no definitive answer can be given to this question. Every piece of armor will eventually have to be replaced. Body armor is not a one-time buy. For example, if a department changes its service weapons or ammunition, the armor worn by its officers must be shown to protect against the new weapons systems. The armor must be capable of defeating typical ammunition threats that the officers may face (see chapter 6). If an agency determines that the ammunition threats that they face have increased, upgrading to a higher level of protection may be appropriate. An individual’s body changes from time to time, and armor that no longer fits or is uncomfortable is likely not to be worn.

Since no two pieces of armor are exposed to identical wear or care, each must be evaluated individually. Armor can generally be classified according to its appearance: “New,” “Good,” “Fair,” or “Poor.” Currently, the only method to evaluate armor’s performance is destructive ballistic testing. The National Institute of Justice (NIJ), through its NLECTC system, is investigating development of alternative methods to evaluate body armor’s ongoing performance and lifespan.

Age alone does not cause body armor’s ballistic resistance to deteriorate. The care and maintenance of a garment—or the lack thereof—have been shown to have a greater impact than age on the length of service life of a unit of body armor. Armor that is 10 years old and has never been issued may be perfectly acceptable for use, provided that the rated level of protection is still appropriate for the typical threats faced. Conversely, 2- or 3-year-old armor that has been worn regularly and improperly cared for may not be serviceable.

Limited studies of the ballistic-resistant capabilities of armor used for extended periods of time were initiated in 1983 by DuPont, at which time some of the armor tested had been in service for more than 8 years. Both the DuPont testing and a 1986 study by NIJ¹⁸ (*Ballistic Tests of Used Body Armor*) found that age alone does not degrade the ballistic properties of armor. Armor manufactured in 1975 that remained in inventory without issue exhibited ballistic-resistant properties identical to those at the time of manufacture. Both research studies included armor that had been in use for as long as 10 years and that had ballistic properties that were indistinguishable from those of unused armor manufactured at the same time.

NIJ tests failed to demonstrate any significant differences in 10-year-old armor, regardless of the extent of use or apparent physical condition. For this testing, 24 Type I vests made of Kevlar®, issued as part of the original NIJ demonstration project in 1975, were returned by the departments. The vests were separated into categories based on use and wear. Eight vests had never been worn, another eight showed signs of heavy wear, and four showed signs of moderate or light wear. The test demonstrated that the armor that had been used showed no significant loss of ballistic performance when compared to the units that were not used.

In contrast, data from the DuPont study showed that used vests had lesser ballistic performance than new vests. Some vests with marginal performance had been in use for only 3 to 5 years. DuPont researchers concluded that, regardless of age, use and abuse can cause ballistic decay. For example, one poorly performing 3-year-old vest appeared to have been exposed to excessive ultraviolet radiation.

DuPont suggests that testing be considered at between 3 and 5 years of use,¹⁹ but NIJ believes that tests are not necessary until the armor has been in service for 5 years. NIJ agrees, however, that armor should be visually inspected at least once a year and that ballistic tests should be conducted if the armor shows signs of excessive wear. If armor is worn only occasionally and properly maintained, there is no reason to be concerned that ballistic-resistant properties have deteriorated. Proper care methods and inspections are addressed in chapter 8.

Independent of the above research studies, some departments have established formal replacement policies based solely on the length of time since the date of issuance. Some departments have selected 5 years for an automatic replacement cycle. Departments need to recognize that a replacement policy should be consistent with the way officers use their armor. If armor is worn only occasionally, such as tactical armor, the policy might be limited to purchasing armor for newly hired recruits and replacing a defined percentage to accommodate problems of fit or excessive wear and tear. However, a department with a high wear rate may wish to select a routine cycle, based on length of service.

Body Armor Testing by Departments

It appears that until further studies are conducted and nondestructive test methods developed, a department has little choice but to routinely conduct ballistic tests of its armor. If it can afford to, a department should initiate test programs to evaluate the ballistic-resistant protection provided by existing armor—particularly if it has armor that is more than 5 years old. The department should consider replacement if the ballistic properties of armor are questionable.

In addition, until NIJ can develop an alternate protocol for ongoing performance assurance testing, all testing should be conducted in accordance with the requirements of NIJ Standard-0101.03. The use of V_{50} ballistic limit testing of body armor produces results that cannot be correlated to the current edition of the NIJ standard. A discussion of V_{50} testing is found in chapter 5.

NIJ recommends that the tests be conducted while the armor is wet. During the 1986 NIJ testing of used vests, two vests were found to exhibit marginal V_{50} ballistic limit when tested wet. When retested after drying, the ballistic limit was satisfactory. Chemical analysis revealed that the fabric lacked proper waterproofing.

Test extensively only when purchasing a significant quantity of armor. Armor testing is expensive, and departments must plan their actions based on their circumstances. For example, a department could probably buy at least four to eight new sets of armor, depending on the threat level, for the cost of one NIJ test.

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A department that elects to implement an armor-testing program must clearly establish the testing objective. If the objective is to satisfy the department that its armor provides appropriate protection, two options exist: a screening test of limited scope or a complete test in accordance with NIJ Standard–0101.03.

Select the worst looking armor for testing. In a screening test, the laboratory might conduct the six-shot NIJ test sequence on a single set of armor—firing one test ammunition against the front panel and the second test ammunition against the back panel with both panels wet. This represents one-fourth of the testing required by the standard and should be less expensive. If armor passes the screening test, there should be no cause for concern. If the armor fails the test, the department should not automatically assume that all of the vests of that particular model owned by the department are unsafe. Rather, this suggests that these particular used vests have questionable protection capabilities. The agency may want to consider conducting additional testing of other units of this model from the same material production lot number, which should be indicated on the ballistic panel label. This testing will help determine if the failure was an isolated one or is representative of the entire purchase lot. If further testing results in additional failures, all vests from that lot of material should be replaced. Also, agencies that experience retest failures should contact NLECTC at 800–248–2742 and arrange to have their vests compared to the originally tested vests stored in NLECTC’s archives. On several occasions, vests that have failed an agency’s retesting have been found to differ in construction from the vest originally tested by the manufacturer as part of NIJ’s voluntary compliance testing program.

When a unit of armor fails testing, the department will probably consider seeking redress from the manufacturer. Before taking such action, departments should do the following:

- Ensure that the vests were originally tested to NIJ Standard–0101.03 before testing samples to that standard’s requirements. A manufacturer can be held responsible only for the terms of the contract it signed and the standards and specifications in that contract. Unless the department’s purchase contract clearly addresses testing armor in service, lists the tests that will be conducted, and specifies the department’s recourse should armor fail tests, NIJ recommends that the department carefully study its situation before proceeding.
- Have the legal adviser examine the contract and any statement on the armor label to determine whether grounds for legal action exist.

If the department decides to go forward with testing, it should contact the manufacturer. Establish in advance testing objectives, action to be taken based on the test results, and the manufacturer’s position. The manufacturer should have the right to be present during the testing. Given the opportunity to work with a department to determine a mutually satisfactory course of action, reputable manufacturers will normally cooperate. Conversely, a manufacturer suddenly confronted with allegations of a problem with its product without prior indication of the department’s planned actions can be expected to become defensive, if not adversarial. Also, a manufacturer may have a legitimate complaint if its product’s performance is questioned based on

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incorrect or improper test results. Even worse, if officers know of questionable data, they may lose confidence in their armor and stop wearing it.

Unless the department has adequate resources and equipment, NIJ strongly recommends using approved independent test laboratories to conduct any ongoing performance testing. A list of approved laboratories can be obtained by contacting NLECTC at 800-248-2742.

A department that wants to conduct its own testing must, at a minimum, have a reliable chronograph and properly conditioned backing material. The use of alternate backing material (phone books, newspapers), and of commercially loaded ammunition of unknown velocity, is certain to provide inconsistent test data that cannot be correlated to testing conducted through NLECTC's voluntary compliance-testing program.

Departments that cannot afford to conduct ballistic testing at independent laboratories should at least follow these NIJ-recommended procedures:

- Inspect each unit of armor carefully upon purchase and prior to issue. Any evidence of poor workmanship or visible differences from samples shown before purchase should be brought to the manufacturer's attention immediately.
- Ensure that each unit of armor is properly and durably labeled in accordance with the requirements of the NIJ standard. Each ballistic panel should be clearly labeled with the NIJ-complying model designation as it appears in the *Police Body Armor Consumer Product List*.
- Upon issue, the quartermaster or supervisor responsible for issuing the equipment should use a permanent marker to legibly enter on the label the name of the officer to whom the armor is issued and the date of issue. If possible, photocopies of these labels should be made and placed in a designated file.
- Institute a routine inspection program for body armor, just as a department would with vehicles or firearms. Develop a written policy on the frequency and extent of these inspections. At a minimum, inspect armor annually in conjunction with firearms training and qualification. The sample form in this manual (appendix E) can be used for this purpose. The International Association of Chiefs of Police (IACP) has prepared a model policy for the use of police body armor, and copies can be obtained from the association. Information on contacting IACP can be found in the Resource List at the end of this document.
- Instruct personnel to report any defects or damage to the body armor immediately. The quartermaster or supervisor should take immediate action to replace any body armor found to be unserviceable. NIJ does not recommend that the agency or anyone else other than the manufacturer attempt to repair damaged body armor.
- Develop written policies regarding guidelines for armor's replacement. A department must thoroughly assess its needs and requirements before instituting such a policy.

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When concealable body armor was first introduced, the limits of deformation to evaluate blunt trauma protection had not yet been established. Sufficient historical data were not yet available to establish a reasonable service life for armor to provide the rated level of ballistic protection. The performance requirements for deformation were first established in 1978, when the NIJ standard was first revised. Consequently, armor purchased prior to 1978 was not tested for compliance with the current deformation requirement.

Similarly, body armor manufactured prior to 1985, when the NIJ standard was revised for the second time, was not tested for penetration resistance when struck at an angle. From 1985 to April 1987, manufacturers had their armor tested for compliance with the requirements of NIJ Standard–0101.02. Unfortunately, testing occurred prior to NLECTC’s establishment and the testing program was administered differently; testing records are incomplete; and the samples tested were not retained in archival storage. Consequently, NLECTC cannot validate the results of testing done in accordance with NIJ Standard–0101.02. Should the manufacturer certification of compliance to NIJ Standard–0101.02 come into question, NLECTC cannot verify that a given armor model was in compliance with the standard or that it is identical to the armor tested.

Thus, any department with armor in its inventory that was purchased prior to the issuance of NIJ Standard–0101.03 in April 1987 might wonder whether that armor is suitable for current use or if it should be replaced. If the armor issued to officers was not tested to determine if it complies with NIJ Standard–0101.03, even if its rated level of protection (armor type) is consistent with current needs, it would be advisable to verify its performance. The only way to ensure that armor purchased to a prior edition of the NIJ standard conforms to the current requirements of NIJ Standard–0101.03 is to test the armor. The names of NLECTC-approved independent testing laboratories (and the individuals to contact to arrange such tests) are available from NLECTC.

10. Administrative Considerations

Training and Education

Departments need to train their officers on the proper care and use of body armor and increase routine wearing of it. To encourage use, departments must educate their officers on the benefits of wearing armor. Possible approaches are discussed below. Citing the statistical information provided throughout this document can also help.

Some departments mandate that officers must wear armor at all times while on duty. When these orders are properly enforced, officers usually wear their armor. However, officers sometimes ignore these orders and relegate their armor to their locker or patrol vehicle's trunk.

Some departments find they can increase the routine use of body armor by taking advantage of the controlled setting of the police academy. These departments issue body armor to all recruits when they report to the academy and require them to wear it throughout the training period. While no firm statistics are available, it appears that such action promotes the routine use of body armor by recruits when they are assigned to duty.

Another approach is to obtain an officer's commitment to wear the armor routinely for a period of at least 1 month. Generally, the officer realizes that the armor is not as uncomfortable as expected and continues to wear the armor thereafter. While the National Institute of Justice (NIJ) is not aware of documented studies, a consensus seems to exist among most officers that the armor "softens" after a short period of wear and becomes more pliable and comfortable.

It is essential that an officer understands that there is no such thing as bulletproof armor. While wearing armor routinely can be reassuring to an officer, the officer must keep in mind that the armor was selected on the basis of limited threat protection. Additional protection, including ballistic helmets, should be worn when an officer may be exposed to a weapon threat greater than the protection provided by normal armor.

At the time armor is issued, departments must ensure that each officer knows the level of ballistic protection provided by the armor relative to various weapon threats. Officers also must know that body armor will not be completely effective against attack by a knife or other sharp instrument, such as an ice pick.

Any training program should emphasize the importance of using good judgment. Departments should require their officers to read the Federal Bureau of Investigation (FBI) Uniform Crime Reports publication, *Law Enforcement Officers Killed and Assaulted*. The incidents described in that report each year reinforce the importance of routine use of body armor to protect against unexpected assaults. The report encourages officers to recognize that seemingly routine assignments, such as serving warrants, can end in armed confrontation.

Issuing Body Armor

Although body armor has been used for more than two decades, it is still a relatively new technology when compared to other types of police equipment. Much remains to be learned concerning its service life, and efforts continue to devise nondestructive methods of assessing the ballistic efficiency of armor that has been worn extensively.

When issuing body armor, a department's first obligation is to ensure that armor fits the officer it is issued to, for fit determines whether it will be comfortable and, to a large extent, whether it will be worn. Armor can be special ordered or tailored for those officers with unusual body dimensions.

Maintaining accurate property records for all armor in inventory is essential. At any time, a department should be able to determine which armor was issued to each officer and the issue date, along with the name of the manufacturer, model number, armor type, and production lot number. The NIJ standard requires that body armor labels include a blank line for the date of issuance. The date should be entered with a permanent marking pen or stamp.

Proper records will be invaluable if a production lot is found to be defective after issuance. If a set of armor is found to be flawed, the department should inspect all armor from the same production lot, for the entire lot may be defective. Also, if armor is purchased from several manufacturers, departments can compare officer satisfaction and use experience for the different products. Good records also can assist in planning for the purchase of both new and replacement body armor.

Body armor will frequently be returned to inventory, often as the result of an officer retiring or accepting other employment. Armor may sometimes be removed from service because it no longer fits the individual to whom it was originally issued. Unless the armor shows signs of abuse, it may be reissued to another officer. NIJ strongly recommends that any unit of armor be carefully inspected prior to reissue. In one instance, an officer's life was spared only days after acquiring armor. The armor had been purchased privately by another officer who sold it upon leaving the department. The officer whose life was saved was its fifth owner.

In addition to reissuing armor to full-time police, a number of departments issue used armor that has been returned to inventory to members of their volunteer corps. Any department that has used but serviceable armor in its inventory should try to issue it to someone who will wear it.

Donating Serviceable Used Armor

Departments that buy armor in large quantities—and that may have routine, scheduled replacement policies regardless of the armor's condition—may want to consider donating armor in good condition to smaller agencies with limited budgets. However, a department should first check with its legal adviser or insurance carrier to determine if this would be permitted under the department's liability insurance and what waivers the recipient department would be required to sign.

Disposing of Body Armor

When body armor is no longer serviceable, the department must dispose of it in a manner that will prevent illicit use. The majority of materials used in manufacturing body armor are either fire-retardant or inherently fireproof, so incineration is not recommended. Cutting or shredding is, at best, a difficult and time-consuming process. Disposal in a public landfill is not recommended, because of both the potential for unauthorized parties to obtain the garments and the environmental concerns caused by disposing materials that may not be readily biodegradable.

One possible option involves using the vests in the door panels of cruisers, behind desks and partitions in police station work areas, or as backstop material at indoor firing ranges. Trauma plates or hard armor inserts are not recommended for these applications due to potential ricochet hazards. If retired concealable armor is used for these applications, the department should remove ballistic materials from the vehicle or equipment before selling or disposing of it. Another option may be to discuss a possible trade-in of old vests when making a new purchase.

Liability

All administrators are painfully aware of the frequent lawsuits filed against police departments. Body armor liability centers on the protection that ballistic-resistant body armor does or does not provide.

In one incident, an officer wearing a vest was killed from an ambush with a high-powered rifle. The survivors' suit alleged that the officer did not know that the armor, intended to protect against handguns only, was incapable of protecting against a bullet from a high-powered rifle.

One individual made the fatal mistake of participating in a live demonstration of body armor involving a knife. The individual encouraged an "assailant" to attack with a knife and subsequently died from wounds received when the knife penetrated the armor. The distributor had covered the armor manufacturer's label with a second label, which stated that the armor would protect against lesser threats than the rated threat level. This resulted in a major lawsuit for compensation against several parties based on the mistaken assumption that a knife is a lesser threat than the ballistic threat specified on the armor label.

NIJ Standard-0101.03 defines levels of ballistic protection only. A knife is not a ballistic threat, and when considered in the context of the level of protection provided by ballistic-resistant body armor, it is not a lesser threat—it is an entirely different type of threat.

Because of incidents such as those described above, the NIJ standard requires that the manufacturer clearly label the level of ballistic protection that the armor is capable of providing in accordance with the types classified in the standard. In addition, the standard requires that the labels on Type I through Type III-A armor include a warning notice that the armor is not intended to protect the wearer against rifle fire and, if appropriate, that the armor is not intended

to protect the wearer from sharp-edged or pointed instruments. All administrators should insist on full compliance with the labeling requirements of the standard.

When an Officer Is Shot

Although there may be no obvious sign of injury, any officer shot while wearing body armor should receive prompt medical attention. The medical staff at the R. Adams Cowley Shock Trauma Center, University of Maryland Medical System, Baltimore, states the following:

Officers and police administrators must be aware of the possibility of blunt trauma injury sustained behind body armor that has stopped a ballistic threat, (i.e., not been penetrated). Any officer who has had their body armor impacted by a ballistic threat should receive a medical evaluation as soon as possible. Even though the officer shows no aftereffects other than soreness or a bruise, the possibility of serious internal injury still exists. A prompt medical evaluation will allow for an assessment of occult serious injury.

Before the officer returns to duty, the lifesaving armor must be replaced with a new set. Retire the armor to a trophy case to advertise gratefully the protection that it afforded. An officer once protected will undoubtedly wear body armor routinely.

Contact the IACP/DuPont Kevlar Survivors' Club® (see appendix A) and inform them of the incident. By sharing this information as part of the Survivors' Club's educational efforts, other officers will be made aware of the benefits of wearing body armor on a routine basis. As a result, other lives may be saved.

Epilogue

For more than 25 years, the National Institute of Justice (NIJ) has been committed to ensuring the safety of the Nation's law enforcement officers through its research efforts and voluntary compliance testing program for body armor. The 2,000-plus lives that have been spared as a result of the use of body armor bears testament to the fact that, as the National Law Enforcement and Corrections Technology Center system's motto states, "Technology Saves Lives."

The information presented in this guide emphasizes the importance of thorough planning at every step in the selection and procurement process. Police administrators and procurement officials need to be aware of the many pitfalls that can result from body armor that is either inadequate or excessive. Both cases can result in deadly consequences for the line officer. Ultimately, an agency's goal is to obtain armor that meets its needs and will be worn routinely by its officers. One thing is certain: **the only armor that is absolutely guaranteed to fail to protect the wearer is the armor that is not worn.**

Administrators should adopt policies to encourage the full-time use of body armor by field personnel. Field supervisors should set an example for officers under their command by always wearing their armor when on duty. All personnel should receive training regarding body armor's capabilities and limitations, as well as proper care methods. All armor should be routinely inspected and when it is determined that it no longer fits properly or is no longer serviceable, it should be replaced immediately.

By disseminating the information in the guide to the appropriate personnel, it is the National Institute of Justice's goal to save even more lives and continue to build upon the success resulting from its body armor standards and testing program.

**DON'T BECOME ANOTHER STATISTIC—
WEAR YOUR ARMOR!**

Endnotes

1. Source is International Association of Chiefs of Police/DuPont Kevlar Survivors' Club®.
2. The National Institute of Justice is the successor to the Law Enforcement Assistance Administration (LEAA), National Institute of Law Enforcement and Criminal Justice (NILECJ).
3. Write to NLECTC, P.O. Box 1160, Rockville, MD 20849-1160, or call 800-248-2742 or 301-519-5060.
4. Source is National Law Enforcement Officers' Memorial Fund, Inc.
5. Dean, Bashford, *Helmets and Body Armor in Modern Warfare*, New Haven, CT: Yale University Press, 1920.
6. *Ballistic Resistance of Police Body Armor, NILECJ-STD-0101.00*, Washington, DC: U.S. Department of Justice, National Institute of Law Enforcement and Criminal Justice, March 1972.
7. Chappell, Kevin, "A Death-Defying Business: Fashion and Fear Fuel Sales of Bulletproof Clothing," *U.S. News & World Report*, 123:6 (August 11, 1997):46-47.
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9. Source is the Bureau of Justice Assistance, Public Safety Officers' Benefits Program
10. Reaves, Brian A. and Pheny Z. Smith, *Law Enforcement Management and Administrative Statistics, 1993: Data for Individual State and Local Agencies with 100 or More Officers*, Washington, DC: U.S. Department of Justice, Office of Justice Programs, Bureau of Justice Statistics, September 1995, NCJ-148825.
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19. See note 16 above.

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Appendix A: Resource List

The products, manufacturers, and organizations discussed in this publication are presented for informational purposes only and do not constitute product approval or endorsement by the National Institute of Justice, U.S. Department of Justice; National Institute of Standards and Technology, U.S. Department of Commerce; or Aspen Systems Corporation.

For further information on the topics, organizations, and products discussed in this publication, please contact the following:

Akzo Nobel Aramid Products Inc.

801-F Blacklawn Road
Conyers, GA 30207
Tel: 800-451-6586
Fax: 770-929-8138
Internet: www.akzonobel.com
Manufacturer of Twaron®.

Allied Signal

Spectra Performance Materials
P.O. Box 31
Petersburg, VA 23804
Tel: 800-695-5969
Fax: 804-520-3388
Internet: www.alliedsignal.com
Manufacturer of SPECTRA fibers.

Concerns of Police Survivors, Inc. (C.O.P.S.)

P.O. Box 3199
South Highway 5
Camdenton, MO 65020
Tel: 800-784-2677
Fax: 573-346-1414
Internet: www.nationalcops.org
E-mail: cops@nationalcops.org

Concerns of Police Survivors, Inc. provides resources to assist in rebuilding the lives of surviving family members of law enforcement officers killed in the line of duty, as determined by Federal criteria. Furthermore, COPS provides training to law enforcement agencies on survivor victimization issues and educates the public about the need to support the law enforcement profession and its survivors.

DSM High Performance Fibers, BV

Eisterweg 3
6422 PN Heerlen, the Netherlands
Tel. 31-45-5436767
Fax. 31-45-5426538
Manufacturers of Dyneema®

DuPont Advanced Fibers Systems

Spruance Plant
P.O. Box 27001
Richmond, VA 23261
Tel: 800-453-8527
Fax: 804-383-4120
Internet: www.dupont.com/afs
Manufacturer of Kevlar® products.

Federal Bureau of Investigation (FBI)

Uniform Crime Reports (UCR)

Criminal Justice Information Service Division
Program Support
1000 Custer Hollow Road
Clarksburg, WV 26306
Tel: 304-625-4995
Internet: www.fbi.gov/publish.htm
Statistics on law enforcement officers killed and assaulted.

International Association of Chiefs of Police (IACP)

515 N. Washington Street
Alexandria, VA 22314-2357
Tel: 800-843-4227
Fax: 703-836-4543
Internet: www.theiacp.org
Model policies available from IACP on a wide range of law enforcement issues, including body armor.

IACP/DuPont

Kevlar Survivors' Club®

5401 Jefferson Davis Highway
Richmond, VA 23234
Tel: 800-441-2746 or 804-383-3853
Fax: 804-383-2477
Contact: Anna Knight, Club Administrator, or Bill Brierley, Law Enforcement Consultant
Maintains the latest statistics on body armor "saves."

National Fraternal Order of Police (FOP)

1410 Donelson Pike, #A17

Nashville, TN 37217

Tel: 615-399-0900

Fax: 615-399-0400

Internet: www.grandlodgefop.org

E-mail: glfop@grandlodgefop.org

The FOP supports the routine use of body armor by all of its members.

National Law Enforcement Officers Memorial Fund, Inc.

605 E Street, N.W.

Washington, DC 20004

Tel: 202-737-3400

Fax: 202-737-3405

Internet: www.1nleomf.com

E-mail: nleomcwf@erols.com

Contact: Craig W. Floyd

Honors all law enforcement officers killed in the line of duty.

National Rifle Association (NRA)

Law Enforcement Activities Division

11250 Waples Mill Road

Fairfax, VA 22030-9400

Tel. 703-267-1628

Internet: www.nra.org/law-enf/NRA-LAWENF.html

Contact: Drienne Perry

Through the NRA, selected body armor manufacturers offer discounts on their products to law enforcement officers who are NRA members.

The National “WE CARE” Foundation

P.O. Box 117617

Carrollton, TX 75011-7617

Tel: 972-492-4189

E-mail: wecare1@airmail.net

A nonprofit organization established in 1990 by the Law Enforcement Television Network (LETN) to assist police officers who are required to purchase their own body armor, but cannot afford to do so. Funds for the program are generated through the use of the Law Enforcement Visa card. A donation is made to the program every time a cardholder makes a purchase with this card. Random drawings are held to determine the recipients of the vests.

Public Safety Officers' Benefits (PSOB) Program

Bureau of Justice Assistance

810 Seventh Street, N.W.

Washington, DC 20531

Tel: 888-744-6513 or 202-307-0635

Fax: 202-307-3373

Internet: www.ojp.usdoj.gov/BJA/html/specprog.htm

The PSOB program provides financial benefits for survivors of officers killed in the line of duty and for officers permanently and totally disabled in the line of duty.

Appendix B: Frequently Asked Questions

The staff at the National Law Enforcement and Corrections Technology Center (NLECTC) handle thousands of calls from the criminal justice community through our 800-number Hotline Center and through the Internet (www.nlectc.org). Below are some of the questions that occur most frequently. Your suggestions and questions are welcome.

Q. We're going to purchase body armor in the near future. Any advice or suggestions?

A. NLECTC has an informational package of publications on the topic of body armor available at no cost. To obtain a package, call NLECTC at 800-248-2742 or 301-519-5060.

Q. How does body armor work?

A. When a bullet strikes a body armor panel, the fibers absorb and disperse the energy of the impact across a generalized area. Most concealable body armor is made of a number of layers. These layers assist in the energy dispersion process and help to reduce the effects of blunt trauma caused by the force of impact energy that is delivered by the projectile.

Q. How long does body armor last?

A. There are a number of factors that can influence the service life of body armor. The National Institute of Justice (NIJ) has done research (detailed in the publication entitled *Old Armor Tests As Good As New* and available from NLECTC at 800-248-2742 or 301-519-5060) that indicates that age is not the only determining factor. Other factors to consider include: how regularly the armor was worn; how it was cared for; whether the armor fit the wearer properly (most people lose or gain weight over a period of years); and the overall condition of the armor (do the fasteners still work properly, and so on). We encourage departments that issue body armor to have a routine inspection program for body armor, just as they would for weapons, vehicles, and other types of issued equipment.

Q. What types of materials are used to make body armor?

A. There are a number of materials used in the manufacturing of body armor. Concealable, or "soft" body armor can be made from a number of different types of woven or nonwoven materials. The most recognized of these is Kevlar®, which is made by DuPont. Other materials include Spectra®, which is made by AlliedSignal, and Twaron®, made by Akzo Nobel. These materials are manufactured in a variety of styles and weaves. Hard armor plates can be made from a number of materials, including metals, ceramics, and other composite materials.

Q. Which ballistic material is better?

A. Each fiber has its own advantages and disadvantages. The construction of the vest (what type or types of materials and the number of layers of each material used) and the weave of the fibers can influence the performance of the vest. To determine which is best for you, look at and try out a number of vests in the protection level you desire. When you narrow your choice to several vests, call NLECTC for the test data. In the end, it is your choice based on the factors that are most important to you.

Q. What threat level of armor should I wear?

A. First assess the type of threat you face on a daily basis. Review data from shooting incidents in your area, as well as the types of weapons being confiscated from suspects. Also factor in what type of sidearm you are carrying; Federal Bureau of Investigation (FBI) Uniform Crime Report (UCR) data indicate that approximately one in six officers killed in the line of duty were shot with their own weapon. Other considerations are: the climate in which you work, typical duty assignment, and personal preference considerations (comfort and fit). Again, the decision is ultimately yours.

Q. Which manufacturer makes the best body armor?

A. NLECTC tests body armor from many manufacturers to verify their products meet minimum performance standards necessary for police use. The test does not compare one manufacturer or their products with another. We recommend that you look at armor from a number of manufacturers. Inquire about their customer service/support, and talk with other agencies about the armor they have purchased and used. Our Consumer Product List gives a complete listing of manufacturers and models that comply with NIJ Standard 0101.03. You can also call NLECTC at 800-248-2742 or 301-519-5060 to get the most current information on models that comply with the standard.

Q. What is the best way to care for body armor?

A. Follow the manufacturer's care instructions provided with your armor or refer to the instructions on the vest labels. Failure to follow these instructions may damage the ballistic performance capabilities of the armor. NLECTC has two publications that discuss body armor care and maintenance: *Selection and Application Guide to Police Body Armor* and *Body Armor User's Guide*, which can be obtained by calling NLECTC at 800-248-2742 or 301-519-5060.

Q. What are trauma plates?

A. Trauma plates are devices that can be added to the vest over a localized area (most commonly center mass of the torso) to increase the wearer's protection against blunt trauma injuries. Trauma plates can be made of a hard substance, such as metal wrapped in rubber or ballistic fabric, or they can be made of layers of ballistic fabric, similar to a vest panel. Some manufacturers even build trauma plates into the vest panel itself.

Q. What new technologies have been developed for body armor?

A. Over the last 20 years, new materials and fabrics have been introduced that have contributed significantly to the wearability of armor. Body armor manufacturers have also made a number of advances in armor design technology, resulting in body armor having more flexibility, weighing less, and ultimately being more comfortable for the wearer.

Q. How do I dispose of my old vest?

A. Check with your department to see if they have a policy regarding the disposal of used body armor. Whenever possible, a used vest that is still in serviceable condition should be issued or donated to an officer who otherwise would not have a vest. If you are not comfortable donating

your vest, contact the manufacturer of your vest to determine if they will dispose of it. Some agencies have also used retired armor in the door panels of police cars or special operations vehicles.

Q. Will my armor stop other threats such as knives?

A. NIJ Standard-0101.03 only addresses the ballistic resistance of body armor, or the armor's ability to stop a specified bullet (depending on threat level classification). At the present time, NIJ does not have a formal testing procedure for stab or cut resistance. Some manufacturers offer vests that are designed to protect the wearer from certain sharp-edged or pointed instruments; however, check the label on the ballistic panel of your vest or check with the manufacturer of your vest to see if it is intended to provide this type of protection. If it indicates that it is, ask the manufacturer to provide you with their independent test results for stab resistance.

Q. How is armor submitted for testing?

A. The manufacturer submitting a vest for testing must first negotiate a testing contract with an NIJ-approved testing laboratory. Neither NIJ nor NLECTC accepts any payment for testing services. The manufacturer then submits six (type I through IIIA) or four (type III and IV) samples to NLECTC, where they are examined for workmanship and labeling requirements, which are defined in NIJ Standard-0101.03. If the samples successfully complete this examination, they are sent to the approved laboratory that the manufacturer has negotiated the testing contract with. The laboratory performs the ballistic test in accordance with the standard and prepares a report of the test. The samples and the report are returned to NLECTC, where they are again examined and compared to the laboratory report. If the armor complies with the standard, a letter is issued to the manufacturer for that model and the model is listed on future editions of the *Police Body Armor Consumer Product List (CPL)*.

Q. Who tests the armor?

A. Only NIJ-approved independent testing laboratories are recognized as official testing facilities for compliance testing to NIJ Standard-0101.03. Call NLECTC for a complete list of approved testing laboratories.

Q. How does a laboratory obtain NIJ approval to conduct body armor testing?

A. To become an NIJ-approved laboratory, the laboratory must submit an application (available from NLECTC) that will be reviewed by NIJ to determine if the laboratory is technically capable of performing the testing. NLECTC will conduct an onsite inspection that includes witnessing the testing of actual samples. The laboratory prepares a report of the test and returns the tested samples and report to NLECTC, where they are checked for accuracy. If the laboratory successfully completes all of these requirements, NIJ will issue a letter to the laboratory notifying it that it is an NIJ-approved laboratory and is authorized to conduct testing in accordance with NIJ Standard-0101.03. Manufacturers and other interested parties will also be notified of the laboratory's status. NIJ accepts applications from interested laboratories on a continuing basis. Laboratories seeking NIJ-approved status should contact NLECTC at 800-248-2742 or 301-519-5060.

Appendix C: The Effect of Body Armor on the Risk of Fatality in Felonious Assaults on Police Officers*

The move by law enforcement to equip its officers with high-quality body armor to better protect them in the event of an assault with a firearm is among the most visible and important contributions to safety in the history of policing. There has never been any serious debate raised about the logic or wisdom of equipping officers with body armor. While body armor is often described as uncomfortable, its use is nonetheless encouraged by most departments and required by many.

Past studies have attempted to determine the actual effectiveness of body armor in protecting the lives of law enforcement officers. These studies could not quantify the protective capabilities of body armor due to a lack of sufficient research design. Fundamentally, the research has been used to show the high percentage of deceased officers who were not wearing body armor at the time they were slain. What these studies attempted, but failed to quantify, was the actual protection provided by body armor.

A recently completed FBI study on protection provided by body armor has shown that the risk of fatality for officers assaulted with a firearm while not wearing body armor is 14 times higher than for officers wearing body armor. The study methodology, known as case-control design, was used to quantify the protection provided by body armor. This approach has been used in medical and public health research such as in the early 1950s and 1980s when it was used to identify the risks associated with smoking and toxic shock syndrome. In this study, it is applied to identify the risk of fatality associated with not wearing protective body armor during an assault with a firearm. This study compares a group of officers who survived an assault with a firearm to a group of officers assaulted with a firearm and slain. Members of both groups were shot with a firearm in the upper torso area; the area traditionally covered by body armor.

A comprehensive FBI database on law enforcement officers killed in the line of duty includes information on whether an officer was wearing body armor at the time of the attack. For this study, cases were selected based on the criterion of whether the officer was shot in an area that could be covered by conventional body armor, i.e., front and rear upper torso. Officers fatally wounded in the head, extremities, or other areas not traditionally covered by body armor were excluded. A group of 25 officers feloniously killed in the line of duty was randomly selected from an available 133 officers who met the initial criteria.

A similar selection process was used to select officers who survived an assault with a firearm. During 1992, the FBI expanded its data collection and solicited information on law enforcement officers who were seriously assaulted in the line of duty and survived. From the cases submitted to the FBI, a small comparison group was produced. This comparison group consisted of 25 officers who survived after being shot with firearms in the upper torso. The officers in the separate groups differed only on the survival outcome of their assaults. By comparing the survival

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outcome of the officers based on their use of body armor, a risk factor can be computed for the odds of fatality for officers shot in the upper torso while not wearing body armor.

In the following table, the relative risk of fatality for officers not wearing body armor is computed. The first column lists the total, 25 officers, who did not survive an assault with a firearm. As shown, only four of the slain officers were wearing body armor at the time of the assault. In contrast, for officers that survived, 18 wore armor at the time of the assault. The odds of fatality for officers not wearing armor is computed as (21/7), or 3. The odds of fatality for officers wearing armor is computed as (4/18), or .22. To arrive at the relative risk between the two groups, the odds of fatality while not wearing armor are divided by the odds of fatality while wearing armor (3/.22), or 13.5. This number can be interpreted as the odds, or relative risk, of fatality. For an officer shot in the torso while *not* wearing body armor, the relative risk of fatality is 14 times higher than for an officer who *is* wearing body armor. Equation 1 shows the computation of the relative risk (Ψ).

Table 1.

	Deceased	Alive	Total
No Armor	21	7	28
Armor	4	18	22
Total	25	25	50

Eq. 1.
$$\Psi = (21 * 18)/(7 * 4) = 13.5.$$

While the absolute risk of fatality could not be computed in this study, it is clear that officers who are not wearing armor at the time of an assault with a firearm are at significantly greater risk of fatality than officers who are wearing body armor at the time of assault. Further, this relative risk of term (Ψ) is not influenced by sample size, so it is likely that this relative risk of fatality would have been observed in samples of any size.

The results of this study affirm what law enforcement trainers have long been telling officers: body armor saves lives. By wearing body armor, a law enforcement officer can significantly increase his or her chances of surviving an assault with a firearm.

*Source: FBI Uniform Crime Reports: *Law Enforcement Officers Killed and Assaulted, 1994.*

Appendix D: Model Procurement Specifications

Terms of agreement

A) Specific Quantity

The *(jurisdiction)* intends to purchase a total of *(number spelled out) (number)* units of body armor. Of this total, *(number spelled out) (number)* shall be specially designed for issue to female officers. The successful bidder further agrees to supply the same model of armor at the unit price cost of the above quantity order for an additional period of *(select appropriate period of time)* months for issue to new officers or replacement purposes.

B) Open End Purchase Agreement (Term Contract)

The *(jurisdiction)* anticipates the purchase of a total of *(number spelled out) (number)* units of body armor during a *(appropriate period of time)*-month period beginning on or about *(date)*. During this period, purchase orders will be issued for armor as needed at the contract unit price. It is estimated that *(number)* percent of the armor purchased will be specifically designated for issue to female officers. The term of this agreement shall be *(appropriate period of time)* months; however, the *(jurisdiction)* does not guarantee the purchase of any specific or minimum quantity of armor during the term of this agreement. The *(jurisdiction)* may, at its option and subject to agreement by the contractor, extend the term of this agreement at the same contract unit price for an additional period of *(appropriate period of time)* months.

Bidding and award

Bids shall be submitted *(specify standard departmental regulations; i.e., departmental form, letter quotation, etc.)*.

Bids will be accepted only for armor that has been tested by an independent testing laboratory as part of the National Institute of Justice (NIJ) National Law Enforcement and Corrections Technology Center (NLECTC) body armor compliance-testing program and found to fully comply with the requirements of NIJ Standard–0101.03 (or current edition).

The *(jurisdiction)* reserves the right to reject any or all bids in whole or in part as it is deemed in the best interest of the department.

In determining the most advantageous bid, the *(jurisdiction)* reserves the right to consider quality, workmanship, service, and dependability of the product and manufacturer, independent of price.

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The successful bidder agrees to provide (*name of manufacturer*) model (*designation*) armor properly identified on the label of each unit of armor.

Note: The model selected, which must be verified as having been tested by a NLECTC-approved testing laboratory and found to comply with NIJ Standard–0101.03, must be incorporated in this document or separate purchase document at the time of award of said contract.

Pre-bid conference

Specify date, time, and location. If attendance is a condition of bid acceptance, this must be noted.

Invoicing and delivery

Specify consistent with the normal procurement practices of the jurisdiction.

Warranty and insurance

Each unit of armor provided under this contract shall be warranted for a minimum of (*number spelled out*) (*number*) years to be free from all defects in materials and workmanship.

Each unit of armor provided under this contract shall be warranted for a minimum of (*number spelled out*) (*number*) years to meet the ballistic-resistant and deformation requirements of NIJ Standard–0101.03 (or such future edition of NIJ Standard–0101.03 that forms the basis of the contract resulting from this bid).

Manufacturers shall have a product liability performance insurance policy in a minimum amount of (*specify per incident and total liability limits, and period of coverage as appropriate based upon recommendations of department’s legal counsel and insurance commission*). All insurance policies shall conform to the rules and regulations of (*appropriate jurisdiction*).

Armor specification

Each unit of armor shall be new, unused, constructed of the highest quality materials, and shall:

- A) Be constructed identically to the original model tested by NLECTC and found to comply with the minimum performance requirements for Type (*appropriate classification*) armor as specified in NIJ Standard–0101.03 (or current edition).

SELECTION AND APPLICATION GUIDE TO POLICE BODY ARMOR

- B) Be labeled in accordance with the requirements of NIJ Standard–0101.03, clearly identifying the exact manufacturer model and, if appropriate, style specified in the contract document.

The manufacturer may, at its option, include in addition a catalog number for supplier or distributor convenience, provided that such number is properly identified and totally separate from the model/style designation line. Labels shall remain readable throughout the warranty period.

- C) Be designed to be concealable under the standard (*jurisdiction*) uniform shirt. Provide full torso coverage, with front-to-back side overlap of ballistic panels. (Alternately, state other side protection requirements or other intended manner of use, such as a specific type of outerwear, i.e., tactical vest.)
- D) Provide adjustment for the chest, waist, and shoulders with the minimum relief under arms, neck, and shoulder necessary to prevent chafing of the wearer.
- E) Be designed in such a manner as to prevent the armor from “riding up” on the wearer during normal duty activities.
- F) All closure, fastening, or accessory attachment devices should be made of materials that do not present a “secondary projectile” or “ricochet” hazard if struck by a bullet.
- G) Incorporate a carrier for the ballistic element that is (*appropriate choice*) in color, and the coloring shall be permanent and not “bleed” onto other garments.
- H) Be free from any defects affecting durability, serviceability, appearance, or the safety of the user. Workmanship and construction details, cutting, stitching, and finishing shall be in all cases in accordance with first-class commercial textile standard practices for the intended purpose.

Items to be submitted with bid

- A) Sample of armor model being bid, labeled in accordance with the requirements above (item B, armor specifications).

Note: The sample provided by the successful bidder will become the property of (*jurisdiction*) and retained in archives for comparison with armor delivered under the resulting contract. Samples provided by unsuccessful bidders will be returned F.O.B. (*jurisdiction and shipping address*) upon request following contract award.

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- B) Proof that the armor model offered has been tested by a NLECTC-approved laboratory and that NLECTC has found that model to be in full compliance with the requirements of NIJ Standard-0101.03.
- C) Proof of liability insurability.
- D) List of customers to whom the bidder has satisfactorily sold armor during the past three (3) years.

Termination of agreement

See commentary.

Acceptance testing

See commentary.

Appendix E: Body Armor Inspection Sheet

Date: _____

Manufacturer: _____ Model/Style: _____

Male _____ Female _____ Size _____

Serial Number: _____

Issued To: _____

Inspected By: _____

Yes No

A. Labeling:

- ____ ____ 1. Is a label securely attached to each part of the carrier and ballistic panels?
- ____ ____ 2. Is information on the labels legible?
- ____ ____ 3. Does the model comply with NIJ Standard-0101.03?

B. General Condition/Appearance

- ____ ____ 1. Does the carrier or permanent cover have any visible rips/tears/holes?
- ____ ____ 2. Is the armor relatively clean and free of dirt and debris?
- ____ ____ 3. Are closure devices securely attached to the vest and operating properly?
- ____ ____ 4. If ballistic element is encased in a nonremovable cover, is any ballistic material (fabric) exposed?
- ____ ____ 5. If ballistic element is not encased in a nonremovable cover, is the ballistic material frayed?
- ____ ____ 6. Are there creases in the armor?
- ____ ____ 7. Is the armor free from odor?

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