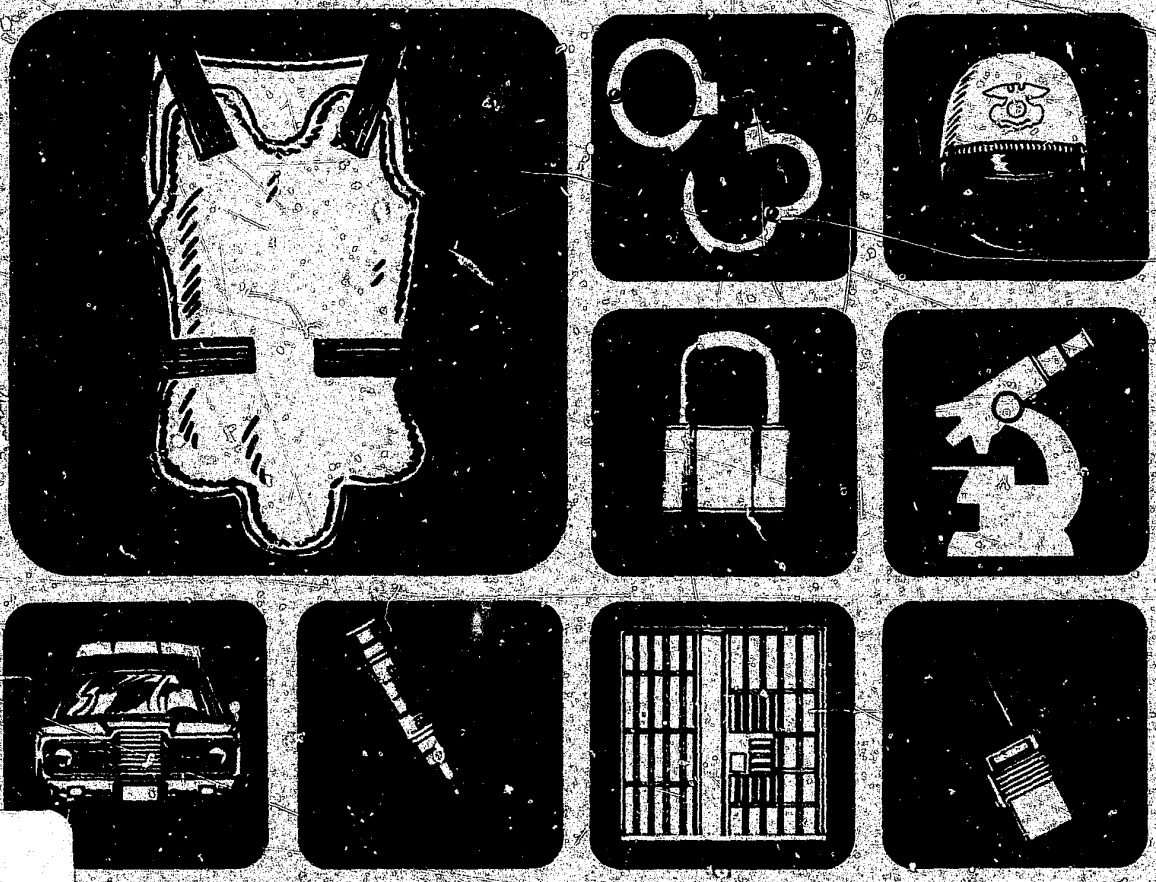
ETC

EQUIPMENT TECHNOLOGY CENTER
CONSUMER PRODUCT REPORT

Police Body Armor



INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE

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POLICE BODY ARMOR TESTING and SUMMARY OF PERFORMANCE TESTING DATA

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Test results and analyses contained herein do not represent product approval or endorsement by the Law Enforcement Assistance Administration, the U.S. Department of Justice; the National Bureau of Standards, the U.S. Department of Commerce; the IACP; or the Denver Research Institute, and H.P. White Laboratory, Inc., who conducted the Police Body Armor Testing for this report.

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FOREWORD

We are pleased to present this report on Police Body Armor Testing. This is the first of many Consumer Product Reports on law enforcement equipment to be issued in the coming months by the Equipment Technology Center. The Center, operated by the IACP with National Institute of Law Enforcement and Criminal Justice (NILECJ) support, was established to test items of equipment commonly used by law enforcement and criminal justice agencies and to make the results of those tests available to criminal justice officials and to manufacturers.

The testing program is part of the National Institute's equipment standards program which sets scientifically sound performance standards for major items of law enforcement gear and then supervises independent tests of commercially available equipment to see if it meets those standards.

Literally billions of dollars are spent on equipment for police and other parts of the criminal justice system. Understandably, decisions about which products to buy frequently turn on questions of economy. Although costs are an important consideration, they should not outweigh such essential factors as the quality and performance of a particular piece of equipment.

The Equipment Technology Center is designed to serve as a consumer advocate and guide for the law enforcement and criminal justice community. In addition to police body armor, the Center is supervising the testing of handheld transceivers, restraining devices, protective head gear, and other products used in the criminal justice system.

The National Institute pioneered the development of soft body armor which is made from a synthetic fiber developed by E. I. du Pont de Nemours and Co. The lightweight armor is intended for inconspicuous daily wear, thus affording continuous protection for the wearer. As part of its research on body armor, the National Institute field tested a total of 4,400 specially fabricated body armor garments plus 800 commercial garments. The results of that effort are reported in another document.*

During the past several years, an increasing number of manufacturers have entered the soft body armor market. Because the product was new, there was little for the consumer to go on in purchasing garments. Given the stakes involved, the Advisory Committee to the Equipment Technology Center strongly urged that commercial body armor be given priority in the laboratory testing program.

The methods used in the testing, and the results, are detailed in this report. It is important to note that criteria and compliance levels for the body armor, as for other equipment to be tested, are established by the Law Enforcement Standards Laboratory of the National Bureau of Standards.

*Body Armor Program—Background and Test Results, July-August 1977, The Aerospace Corporation.

In the case of the body armor, the testing methods were designed to measure the garments' resistance to bullets from the most frequently used handguns and from several other less-common firearms. To give police useful information, the garments are classified according to the level of protection they afford. In other words, the test results show the performance of each model tested in resisting penetration or deformation by the blunt force of bullets from guns of a specific caliber: for example, a .38 caliber revolver with a four-inch barrel.

Of the 53 models tested, 25 did not comply with the standard. Some manufacturers are now exploring the reasons why certain models did not meet the standard. Once these models are submitted for retesting, the results will be incorporated in a revised Consumer Product Report for law enforcement purchasing agents.

We are confident that industry shares our concern that this and other important equipment fully meet the requirements of the law enforcement and criminal justice community. In the case of the body armor, the safety of thousands of police officers depends on it.

Norman Darwick, Director
Bureau of Operations and Research
International Association
of Chiefs of Police

Paul Cascarano, Assistant Director
National Institute of Law Enforcement
and Criminal Justice

EXECUTIVE SUMMARY

The Police Body Armor Testing Program was conducted through the Equipment Technology Center of the IACP under a $589,088 grant from the Law Enforcement Assistance Administration. The Center is part of a larger equipment standards program operated by the National Institute of Law Enforcement and Criminal Justice, LEAA's research arm.

The program entails developing scientifically based performance standards for various items of equipment, a function carried out under Institute guidance by the Law Enforcement Standards Laboratory at the National Bureau of Standards. Once the standards have been established and carefully reviewed, the Equipment Technology Center supervises independent testing of equipment used by law enforcement and criminal justice agencies. Among the equipment scheduled for testing under the program are: communications, security systems, weapons, emergency equipment, investigative aids, protective equipment, and vehicles.

Test results are published in a Consumer Product Report intended to help law enforcement and criminal justice purchasing officials make informed purchasing decisions.

The body armor testing project began in 1976 with the setting of test goals and development of performance criteria and testing methods. The National Bureau of Standards established the criteria and testing methods based on a lengthy research and development effort sponsored by the National Institute, which pioneered the development of soft body armor.

The next step in the process was to identify and certify independent laboratories qualified to perform the tests on body armor. Two laboratories were selected from among 14 submitting bids. Each of the two proposed laboratories was then examined by a certification team from the National Bureau of Standards to ensure that their capabilities and equipment met the stringent requirements for the body armor testing.

The weapons chosen for the test match those commonly used against police. For example, the largest number of weapons that police confiscate are .38 caliber and smaller. Thus, these guns were classified as Threat Level I. Five levels of threat were delineated:

Threat Level I	.22 caliber and .38 caliber
Threat Level IIA	low velocity 9mm and .357 magnum
Threat Level II	high velocity 9mm and .357 magnum
Threat Level III	7.62mm (.308 Winchester)
Threat Level IV	30.06 armor piercing

Each garment was tested under strictly controlled conditions by being placed in front of a clay block, which was of a measured consistency and temperature, and fired upon from a prescribed distance with carefully loaded ammunition to ensure uniformity throughout.

Each garment was subject to being fired at five times. Firing was terminated at any time penetration or excessive deformation occurred. The Threat Level IV garment was subject to only one shot.

Of 53 models tested, 25 did not comply with the established standard. Of the 25 which did not comply, 17 had complete penetrations and 8 experienced deformation. The latter type of noncompliance occurs when a depression in the clay backing is recorded in excess of 1.73 inches, a level recommended by the United States Army as meaningful in determining the possible extent of injury to the wearer.

Tests were also conducted on wet garments to simulate a condition that would occur with normal wear. There were 10 noncompliance wet garments; the majority of them (7) were penetrated.

Three manufacturers had a 100 percent compliance rate. The remainder had models that withstood some threat levels but not others. Although the rate of compliance was disappointing, it is hoped that manufacturers will voluntarily review their products to ensure higher levels of compliance in the future. Manufacturers whose garments failed to meet the standard have been notified and invited to submit new garments for further examination and testing.

This Consumer Guide is intended for police administrators and officers who are contemplating the purchase of body armor, whether in quantity or on an individual basis. As retesting of garments is performed, the new results will be published.

ABOUT THE EQUIPMENT TECHNOLOGY CENTER

Because equipment is a major budget item for law enforcement agencies, the National Institute of Law Enforcement and Criminal Justice awarded funds to the International Association of Chiefs of Police to operate the Equipment Technology Center. ETC is part of IACP's Bureau of Operations and Research. It was established to fill the need of the law enforcement community for accurate information and technical assistance before equipment is procured. In the past, most purchasers of law enforcement equipment were required to rely on the untested claims of manufacturers and/or the opinions of other consumers. However, experience showed that more often than not neither of these sources provided reliable information for evaluating law enforcement equipment before it was purchased.

Five major categories of equipment are included in the ETC program:

- Communications and Electronics
- Forensic Science
- Security Systems
- Transportation
- Weapons and Protective Equipment

The establishment of ETC marked the beginning of a program which has integrated the efforts of NILECJ, IACP, and the Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards (NBS) to serve the equipment needs of the law enforcement community.

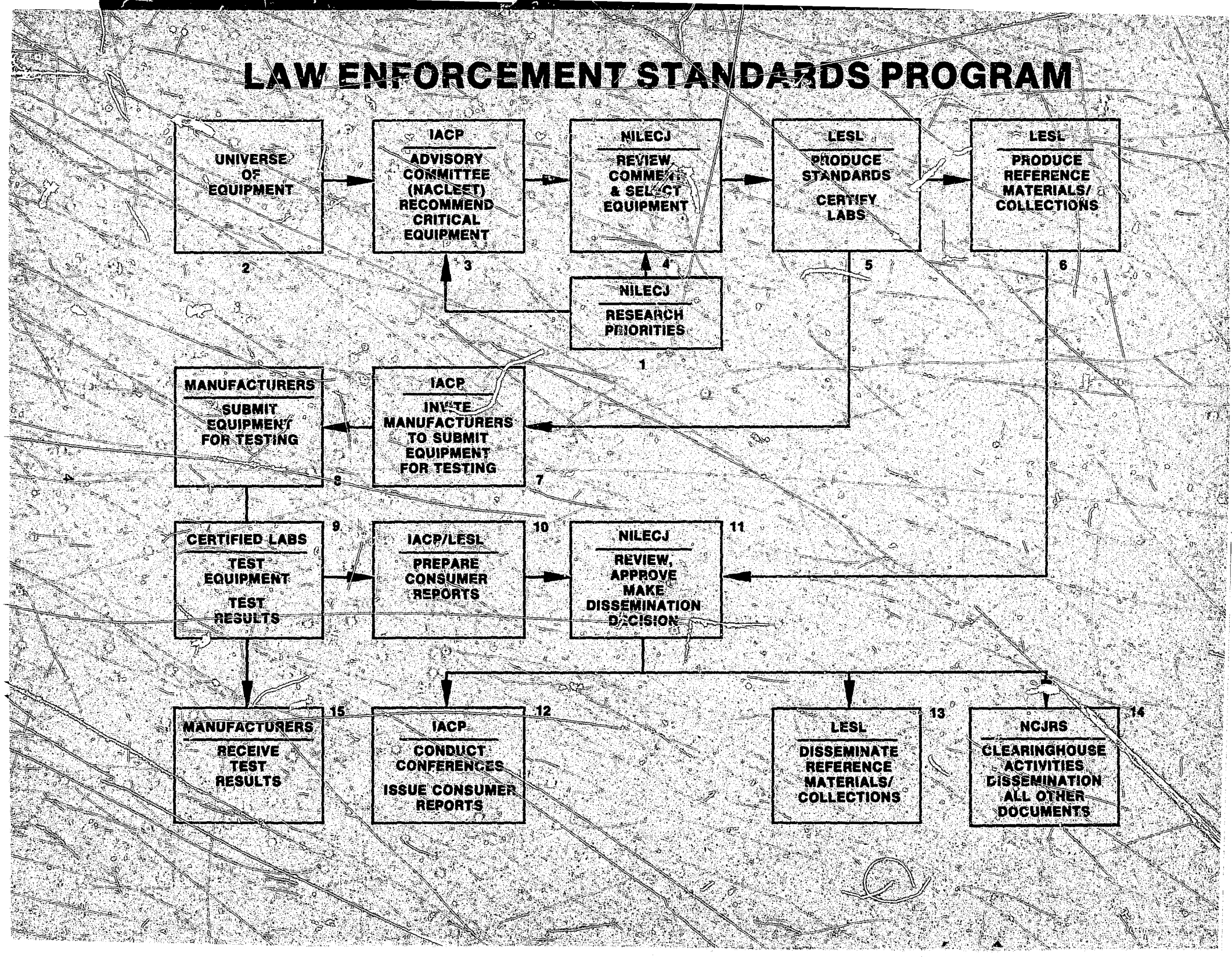
Each participant in the program has supporting roles and each is involved in the coordinated effort to produce consumer reports for the users of law enforcement equipment. (See chart showing relationships and steps in the Law Enforcement Standards Program).

The program involves NILECJ assistance to IACP in determining the needs of the law enforcement community for police equipment and integrating those needs with the programs of LESL. These objectives are accomplished by several interrelated programs designed to:

- Identify the most critical police equipment needs.
- Develop standards for the most critical police equipment.
- Test those items of police equipment in qualified laboratories.
- Produce consumer reports as guidelines for purchasing police equipment.

In early 1978, ETC began the testing phase of the program which has centered its attention on specific items of equipment. These items had previously been identified as priority needs of law enforcement officers by the National Advisory Committee for Law Enforcement Equipment and Technology (NACLEET).

LAW ENFORCEMENT STANDARDS PROGRAM



Advisory Committee. NACLEET has a dual role in the ETC program—as an integral part of ETC and as an advocate for the law enforcement community.

The functions of the NACLEET include:

- Serving as a consumers'/users' forum in matters involving products and equipment in the program's five major areas of interest
- Recommending priorities in equipment requirements and needs
- Recommending priorities in selecting products and equipment that should be assessed
- Recommending products and equipment that should be developed and tested
- Recommending minimal operational requirements for specific products and equipment
- Redefining areas requiring additional research, testing, and development

The NACLEET is appointed by IACP with the approval of LEAA/NILECJ. Members of the Committee are a diverse group, carefully selected on the basis of their knowledge and expertise in specific areas of law enforcement.

A list of the Advisory Committee members and officers for 1977-78 is included inside the front cover.

The priorities of the law enforcement equipment program are established by a process which illustrates the close coordination of effort required by IACP, LEAA, and LESL to achieve the many objectives of the program. To some extent, LEAA/NILECJ influences the selection of priorities, although the final priorities are established by the ETC staff and by NACLEET. From time to time, a change in circumstances may require a change in emphasis and an adjustment in the priorities of the program.

Some of the factors which have influenced the selection of priorities are:

- The ETC Equipment Needs Survey—a poll of the law enforcement community
- Advice and judgment of staff members from IACP, LEAA/NILECJ, and LESL
- Advice and judgment of NACLEET
- Priority of the need in the law enforcement community
- The availability of a LESL or other pertinent standard
- Cost-effectiveness of the tests
- Estimated benefit to the law enforcement community

The Testing Program. The equipment testing program involves a succession of steps which are intended as guarantees of fairness and accuracy to all connected with the process. Briefly, the steps followed are:

- NACLEET approves standard.
- LEAA/NILECJ approves product for testing.
- Testing program announced in Commerce Business Daily.
- Manufacturers submit products for testing.
- LESL evaluates and approves testing laboratories.
- Development of a uniform format for reporting test results.
- IACP contracts with testing laboratories.
- IACP monitors testing.
- Joint review of test results by IACP, LEAA/NILECJ, and LESL.
- Opportunity for each manufacturer to comment on test results.
- Final review and approval of test results by IACP, LESL, LEAA, and NILECJ.
- Publication of test results.

The evaluation and approval of the testing laboratories is one of the most critical steps in the equipment testing program. This function is performed by LESL with the assistance of another group in NBS, the Office of Testing Laboratory Evaluation Technology (OTLET). The OTLET group assesses the ability of testing laboratories to carry out the tests required by LESL standards and certifies the laboratories to perform the tests. After the tests are completed, the results are published in an appropriate format.

POLICE BODY ARMOR TESTS

SOFT BODY ARMOR DEVELOPMENT

Since the early sixties, there has been an alarming increase in assaults, serious injuries, and deaths inflicted on law enforcement personnel in performance of their duties.

In 1976, there were 49,079 assaults on police officers which resulted in 19,000 personal injuries. Almost 16,000 of the assaults occurred with the law enforcement officer responding to calls such as "family quarrels" or "man with a gun."

From 1967 to 1971, 455 police officers were killed; in the next four years the number increased to 622. From 1967 to 1976, 1,019 law enforcement officers were killed with handguns, rifles, and shotguns. In 1976 alone, 94 officers were slain with firearms.

Although conventional armor such as flak jackets was used by police in high-risk situations, nothing on the market at that time was suitable for continuous wear. Responding to the need, the National Institute in 1972 began a lengthy research and development effort to fashion a protective garment that would be lightweight and flexible enough to be worn routinely by law enforcement officers.

One of the first tasks of the development effort was to determine which weapons were most likely to be used against the law enforcement officer. Based on a survey conducted by the International Association of Chiefs of Police, it was clear that handguns represented the greatest threat. Of almost 23,000 weapons confiscated by police from 1971 through 1976, nearly 19,000 were handguns. Other confiscated weapons included shotguns and rifles. The largest category of confiscated handgun was the .38 caliber revolver; the next was the .22 caliber. The others were, in descending order, .25 caliber, .32 caliber, and .357 magnum.

The experimental body armor specially fabricated and tested by the Institute was designed to withstand the predominant threat—the .22 and .38 caliber weapons, which represent 85 percent of the handguns confiscated. Field tests of the Institute-designed body armor in 15 cities found the garments to be wearable and capable of protecting the officers.

While the experimental work on the soft body armor proceeded, more and more manufacturers began to develop versions of the lightweight armor. Because of the newness of the material and the varieties of construction, it was difficult for a potential purchaser to evaluate the various body armors. The development of a standard and the body armor tests reported here were designed to fill that gap. Through careful testing under controlled conditions, the actual performance of various models of currently available commercial body armor was evaluated.

THE STANDARD

The police body armor tests were conducted in accordance with revised standard NILECJ-STD-0101.01, "Ballistic Resistance of Police Body Armor," which is summarized on page 21. This standard, as noted, was developed by the Law Enforcement Standards Laboratory of the National Bureau of Standards and adopted by NACLEET as the standard for this body armor testing program. Highly qualified specialists and technicians work up to two years to produce an acceptable standard. Other items of equipment will also be tested against LESL standards.

The threat levels in the standard were based on the confiscated weapons statistics. Because the greater percentage of the weapons confiscated were .38 caliber and smaller, this was designated as Threat Level I. The next category, the .357 magnum and the 9 mm semiautomatic, was designated as Threat Level IIA. The IIA definition was developed because 95 percent of the weapons carried by police are 4" barrel revolvers and have a lower muzzle velocity than their companion 5", 6", and 8 3/8" barrel .357 magnums. The lower velocity 124 grain 9 mm was included in IIA because of its commercial availability and because it is further used in a 4" barrel semiautomatic.

Threat Level II was considered the highest energy threat level for soft body armor and once again included the .357 magnum and 9mm as the threat level test rounds. This threat level was predicated by the introduction of +p ammunition, the importation of the foreign-manufactured 9 mm high-velocity FMJ military bullets and submachine guns, and the wealth of high-velocity handgun ammunition that began to appear on the American market.

Threat Level III is addressed for protection from shoulder weapons and military ball ammunition, but does not include handguns such as the .44 magnum and .41 magnum for their blunt trauma potential.

Threat Level IV addresses a garment designed to protect the wearer from the armor-piercing bullet fired from a shoulder weapon. It is almost always extremely heavy, bulky, and constructed of steel, fiber glass, or ceramic, or various combinations of the three.

The table on the following page is offered as an explanation of the determined threat ammunition levels.

THE LABORATORIES

Shortly after the Equipment Technology Center was established, its advisory board, the National Advisory Committee for Law Enforcement Equipment and Technology, began prioritizing police equipment needs. Assigning priorities for equipment that should be tested is a difficult task. Among the four specialized NACLEET subcommittees (now expanded to five), the competition was predictably fierce. After several meetings and recognition of the limited funds available for testing, the entire NACLEET membership agreed that the prevailing problem was police body armor.

Independent testing laboratories were invited to respond to "Requests for Proposals" by IACP. Prior to final proposal acceptance, IACP and LESL personnel visited the laboratories to determine technical capabilities. Once capabilities were determined and testing was begun, there was no further input to the testing procedure other than on-site observation by IACP, LEAA/NILECJ, and LESL personnel. The results stand by themselves, based on (1) an acceptable standard and (2) a qualified testing laboratory.

The testing laboratories conducting the body armor testing were the H. P. White Laboratory, Inc., Bel Air, Maryland, and the Denver Research Institute, Denver, Colorado.

THE METHODS

All body armor samples were tested in accordance with requirements and procedures set forth in the NILECJ Standard "Ballistic Resistance of Police Body Armor" summarized on page 21.

For informational purposes, again note that the definitions of the various threat levels were made in direct response to what was needed and believed to be the top priorities, #I, IIA, II, III, and IV in that order. Likewise, the selection of the test ammunition was also made in direct response to what was believed to be the caliber that was most often used on the street at that threat level.

The weapon used was set to fire a bullet under the most severe testing conditions possible, exactly perpendicular to the armor and at a distance from the armor so as to impact at its highest measured velocity. This allows the bullet to stabilize, thereby maximizing the possibility of penetration.

The test required that five shots be fired at a sample garment and that each shot hit at least two inches apart from any other hit to determine whether the garment affords ballistic protection over the complete torso, not just in the so-called vulnerable area. Some argument can be made that this requirement for five test shots spaced apart is excessive, based on statistical evidence that most law enforcement officers who have been wounded or killed actually received no more than three hits during a shooting incident. However, this ignores the pattern of hits. Evidence also reveals that the three hits do not impact closely together, but show a more random pattern spread out over the torso or body area. For example, a right-handed shooter's second shot ordinarily impacts higher and to the left of his first shot. Conversely, a left-handed shooter's second shot usually hits above and to the right of his first shot. Accordingly, the somewhat random pattern of hits which is found for most shooters strongly supports the standard's requirement

THREAT LEVELS

	Test Variables				Performance Requirements		
Armor Type	Test Round	Nominal Bullet Mass	Suggested Barrel Length	Required Bullet Velocity	Required Fair Hits Per Armor Part	Permitted Penetrations	Maximum Depth of Deformation
I	22 LRHV Lead	2.6 grams 40 grains	15 to 16.5 cm 6 to 6.5 in	320+12 m/s 1050+40 ft/s	5*	0	44 mm 1.73 in
	38 Special RN Lead	10.2 grams 158 grains	15 to 16.5 cm 6 to 6.5 in	259+15 m/s 850+50 ft/s	5*	0	44 mm 1.73 in
IIA	357 Magnum JSP	10.2 grams 158 grains	10 to 12 cm 4 to 4.75 in	381+15 m/s 1250+50 ft/s	5*	0	44 mm 1.73 in
	9mm FMJ	8.0 grams 124 grains	10 to 12 cm 4 to 4.75 in	332+15 m/s 1090+50 ft/s	5*	0	44 mm 1.73 in
II	357 Magnum JSP	10.2 grams 158 grains	15 to 16.5 cm 6 to 6.5 in	425+15 m/s 1395+50 ft/s	5*	0	44 mm 1.73 in
	9mm FMJ	8.0 grams 124 grains	10 to 12 cm 4 to 4.75 in	358+15 m/s 1175+50 ft/s	5*	0	44 mm 1.73 in
III	7.62mm (308 Winchester FMJ)	9.7 grams 150 grains	56 cm 22 in	873+46 m/s 2863+151 ft/s	10*	0	44 mm 1.73 in
IV	30-06 AP	10.8 grams 166 grains	56 cm 22 in	838+15 m/s 2750+50 ft/s	1	0	44 mm 1.73 in

*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 3 fair hits. The deformations due to the first two fair hits shall be measured to determine compliance.

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

for five shots on each garment. In addition, woven materials are not homogeneous and may have weaker or stronger areas depending on the manufacturer's control processes during fabrication of the material. Thus five shots constitute a reasonable averaging of the entire armor area.

A sample of the body armor was tested until it failed to meet any of the tests required for its particular class or until the test was satisfactorily completed. Consequently, when a sample of body armor failed any test prescribed for its class, the testing of that sample was stopped and no further tests were made of it.

As an example, Model 12516 was tested in a dry condition for Threat Level I with a .38 caliber weapon. In this instance, Model 12516 failed by a penetration on the third impact. As a result of this failure, no other tests were conducted on Model 12516.

If Model 12516 had passed the .38 caliber test successfully, the table would also have indicated the results obtained by firing a .22 caliber 40 grain LRHV in the next of the test series. However, if during this phase, the .22 caliber had penetrated the armor or created a deformation in the clay backing of more than 1.73 inches, the evaluation would have been terminated for noncompliance with the deformation requirement of the standard.

Under the requirements of the standard, penetration by a fair hit or deformation to a depth greater than 44 mm (1.73 in.) constitutes noncompliance of the armor.

TEST RESULTS

POLICE BODY ARMOR TEST RESULTS

The following tables summarize the results of the ballistic evaluation of the police body armor that was submitted for testing to the Denver Research Institute (D) and the H. P. White Laboratory (HP).

"X" in a column of a table is used to indicate the "Threat Level" for which a model of body armor has been tested; also to show whether that model was found to be in "full compliance" or "noncompliance" with the standard.

If a model is marked with "X" in the "Noncompliance" column, an additional notation has been made in the "Noncompliance Data" column to show what test the model did not meet: for example, penetration or deformation, wet or dry, or other pertinent data.

A few comments are in order concerning use of the body armor test data. By now it becomes apparent that the lower threat-level garments are relatively comfortable (weight-wise) to wear. As higher threat levels are addressed, the garments become increasingly heavy and less comfortable to wear. In other words, the officer must sacrifice comfort and wearability to attain protection against higher threat levels.

No garment manufactured is "bullet proof." The term "bullet proof vest" has been used since crime shows on radio and TV have become popular. Just about anything worn by a police officer as body armor can be "defeated." When it is defeated, the results are usually disastrous. What this report provides (as all future equipment testing reports will provide) is an opportunity for the police executive to make a decision based on *all available information.*

The police executive who purchases armor designed for the higher threat levels may sometimes discover that it is being "worn" in the trunk of the police car. It may be better to protect against the "common threat" (Levels I or IIA) and be certain of at least some protection. The choice, of course, is up to the chief police executive.

The summary of test results which follows will aid the law enforcement officer in selecting from the list of manufacturers and their tested armors the particular threat level garment which is most comfortable to wear in the climate of his geographical area.

POLICE BODY ARMOR

SUMMARY OF TEST RESULTS ALPHABETICALLY BY MANUFACTURER

Manufacturer	Model	Threat Level					Compliance		Noncompliance Data
		I	IIA	II	III	IV	Full	Non	
A & B Industries, Inc.	102	X						X	Deformation (dry)
	202		X					X	Deformation (dry)
	300			X			X		
	302			X			X		
American Body Armor & Equipment Co.	K27MC[1]			X				X	Penetration (dry)
	K27HD			X				X	Penetration (dry)
	K15			X				X	Penetration (dry)
Armour of America	Ultrathin	X					X		
	Armorhide		X					X	Penetration (wet)
	Armorhide-P			X			X		
	GP588					X	X		
	GP586				X			X	Penetration (dry)
Blauer Mfg. Co., Inc.	12516	X						X	Penetration (dry)
	12532		X					X	Penetration (wet)
Burlington Industries, Inc.	Not Designated	X					X		
	78002		X				X		
	26018			X			X		
General Ordnance Equipment Co.	120			X[2]				X	Penetration in nylon area of Level II not covered by steel plate (wet)
	217			X				X	(Same as above) (dry)
	434C			X				X	(Same as above) (dry)
International Protectors, Inc.	Mini MK15	X					X		
	MiniProtector		X				X		
	Mini Protector			X			X		
	Mini Protector/ Steel Insert				X		X		
Magnum Armor	1000	X						X	Deformation (wet)
	2000			X			X		
Morton Co.	FSN8470-926-1574					X	X		
Point Blank Body Armor	10	X					X		
	15		X				X		
	20			X				X	Deformation (dry)
Progressive Apparel Co.	ES8	X						X	Deformation (wet)
	ES15		X					X	Penetration (wet)
	ES23			X			X		
Protective Apparel Corp. of America	PGC-10	X					X		
	PGC-10(F)	X					X		
	PGC-18		X				X		
	PGC-18(F)		X					X	Deformation (female bust area) (dry)
	PGC-30			X				X	Penetration (dry)
	PGC-22			X				X	Penetration (dry)
	PGC-1			X			X		
Protective Materials Co., Inc.	Featherflex	X					X		
	Not Designated		X					X	Penetration (dry)
	Not Designated			X				X	Penetration (wet)
	PA500					X	X		
	PA500AP					X	X		
Safariland Ballistics, Inc.	M1-2W	X					X		
	M2-2W		X				X		
	M2A-2W			X				X	Penetration (wet)
	M3-2W			X			X		
Second Chance Body Armor, Inc.	X	X						X	Penetration (wet)
	Y		X					X	Deformation (wet)
	Z			X				X	Deformation (dry)
Technipol International Corp.	KXX+1			X			X		

[1] Type II Front, Type I Back

SUMMARY OF TEST RESULTS--BY THREAT LEVEL

Threat Level I

Manufacturer	Model	Compliance		Noncompliance
		Full	Non	Data
A & B Industries, Inc.	102		X	Deformation (dry)
Armour of America	Ultrathin	X		
Blauer Mfg. Co., Inc.	12516		X	Penetration (dry)
Burlington Industries, Inc.	Not Designated	X		
International Protectors, Inc.	Mini MK15	X		
Magnum Armor	1000		X	Deformation (wet)
Point Blank Body Armor	10	X		
Progressive Apparel Co.	ES8		X	Deformation (wet)
Protective Apparel Corp. of America	PGC-10 PGC-10(F)	X X		
Protective Materials Co., Inc.	Featherflex	X		
Safariland Ballistics, Inc.	M1-2W			
Second Chance Body Armor, Inc.	X		X	Penetration (wet)

Threat Level IIA

Manufacturer	Model	Compliance		Noncompliance
		Full	Non	Data
A & B Industries, Inc.	202		X	Deformation (dry)
Armour of America	Armorhide		X	Penetration (wet)
Blauer Mfg. Co., Inc.	12532		X	Penetration (wet)
Burlington Industries, Inc.	76002	X		
International Protectors, Inc.	Mini Protector	X		
Point Blank Body Armor	15	X		
Progressive Apparel Co.	ES15		X	Penetration (wet)
Protective Apparel Corp. of America	PGC-18 PGC-18(F)	X	X	Deformation (female bust area) (dry)
Protective Materials Co., Inc.	Not Designated		X	Penetration (dry)
Safariland Ballistics, Inc.	M2-2W	X		
Second Chance Body Armor, Inc.	Y		X	Deformation (wet)

SUMMARY OF TEST RESULTS—BY THREAT LEVEL

Threat Level II

Manufacturer	Model	Compliance		Noncompliance Data
		Full	Non	
A & B Industries, Inc.	300	X		
	302	X		
American Body Armor & Equipment Co.	K27MC		X	Penetration (dry)
	K27HD		X	Penetration (dry)
	K15		X	Penetration (dry)
Armour of America	Armorhide-P	X		
Burlington Industries, Inc.	26018	X		
General Ordnance Equipment Co.	120		X	Penetration in nylon area of Level II (front) not covered by steel plate (wet)
	217		X	(Same as above) (dry)
	434C		X	(Same as above) (dry)
International Protectors, Inc.	Mini Protector	X		
Magnum Armor	2000	X		
Point Blank Body Armor	20		X	Deformation (dry)
Progressive Apparel Co.	ES23	X		
Protective Apparel Corp of America	PGC-20		X	Penetration (dry)
	PGC-22		X	Penetration (dry)
	PGC-1	X		
Protective Materials Co., Inc.	Not Designated		X	Penetration (wet)
Safariland Ballistics, Inc.	M2A-2W		X	Penetration (wet)
	M3-2W	X		
Second Chance Body Armor, Inc.	Z		X	Deformation (dry)
Technipol International Corp.	KXX+1	X		

Threat Level III

Manufacturer	Model	Compliance		Noncompliance Data
		Full	Non	
Armour of America	GP588		X	Penetration (dry)
International Protectors, Inc.	Mini Protection Steel Insert	X		

Threat Level IV

Manufacturer	Model	Compliance		Noncompliance Data
		Full	Non	
Armour of America	GP588	X		
Norton Co.	FSN 8470-926-1574	X		
Protective Materials Co., Inc.	PA500	X		
	PA500AP	X		

SUMMARY OF BALLISTIC TEST DATA

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material In Vest (K-Kevlar N-Nylon)
A & B Industries Inc.	102	2018	I	D	.38		X		1.87[1]	866	1	8K
		2019	I	D	.38	X			1.78[1]	881	1	8K
	202	2023	IIA	HP	.357		X		1.95[1]	1220	1	11K
	300[2]	2021	II	D	9mm	X			1.46	1215		26K
		——	II	D	.357	X			1.63	1362		26K
	302[2]	2020	II	D	9mm		X		1.35	1219		26K
			II	D	.357		X		1.56	1427		26K
American Body Armor & Equipment Co.	K27-MC	2076	II[3]	HP	.357		X	X	——	1400	5	16K 2N Steel Plate
	K27-HD	2077	II	HP	9mm		X		0.80	1170		16K 2N
		2088	II	HP	.357		X	X	——	1419	1	16K 2N
	K15	2078	II	HP	9mm		X		1.20	1128		16K 2N
		2087	II	HP	.357		X	X	——	1399	5	16K 2N
Armour of America	Ultrathin	1907	I	HP	.38	X			1.65	888		11K
		2024	I	HP	.22		X		0.70	1138		11K
		——	I	HP	.38		X		1.20	882		11K
		2025	I	HP	.22	X			0.60	1059		11K
	Armor-hide	2028	IIA	D	9mm		X		1.48	1077		15K
		——	IIA	D	.357		X		1.70	1269		15K
		1917	IIA	D	9mm	X		X	——	1088	1	15K
	Armor-hide-P	2027[4]	II	D	.357		X		1.65	1440		17K
	GP588/ 90629[5]	2030	IV	HP	30.06		X		——	2755		Ceramic-N
	GP588/ 86039A[5]	2031	III	HP	7.62		X	X	——	2823	4	Ceramic-N

[1] Deformation is greater than 1.73 inches allowed by NILECJ STD-0101.01
[2] Armors have same ballistic construction
[3] Type II Front, Type I Back
[4] Dry Test only
[5] Same Model tested at Levels III and IV

SUMMARY OF BALLISTIC TEST DATA (Continued)

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material In Vest (K-Kevlar N-Nylon)
Blauer Mfg. Co., Inc.	12516	2090	I	HP	.22		X	X	——	1053	3	8K
	12532	2091	IIA	HP	.357		X		1.65	1273		16K
		2092	IIA	HP	9mm		X		1.25	1107		16K
		1908	IIA	HP	9mm	X		X	——	1078	4	16K
Burlington Industries, Inc.	Not Designated	2032	I	D	.22	X			0.92	1065		10K
		——			.38	X			1.60	860		10K
		2033	I	D	.22		X		0.81	1055		10K
		——			.38		X		1.52	862		10K
	78002	2034	IIA	D	9mm		X		1.46	1115		16K
		——			.357		X		1.73	1244		16K
		2035	IIA	D	9mm	X			1.67	1028		16K
		——			.357	X			1.62	1300		16K
	26018/5328	2036	II	HP	9mm		X		1.40	1176		21K-18P-2N
		——		HP	.357		X		1.50	1360		21K-18P-2N
		2037	II	HP	9mm	X			1.10	1143		21K-18P-2N
		——		HP	.357	X			1.50	1370		21K-18P-2N
General Ordnance Equipment Co.	120	2012	II(F)	HP	9mm		X		0.00	1143		steel-N
		——	I(B)	HP	.38		X		0.75	883		steel-N
		2013	II(F)	HP	.357		X		1.00	1367		steel-N
		——	I(B)	HP	.22		X		0.20	1050		steel-N
		1913	II	HP	.357	X			0.80	1387		steel-N
		——	II	HP	.357	X			0.80	1385		groin pad & vest
		1914	II(F)	HP	9mm	X		X'	——	1148	1	steel-N
	217	2010	II	HP	.357	X		X'	——	1403	4	steel-N
		2011	II	HP	9mm		X	X'	——	1146	1	steel-N
	434-C	2008	II	HP	9mm		X	X'	——	1157	2	steel-N
		2009	II	HP	.357		X	X'	——	1377	1	steel-N

' Penetration was in nylon area not covered by steel plate.

SUMMARY OF BALLISTIC TEST DATA (Continued)

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material In Vest (K-Kevlar N-Nylon)
International Protectors, Inc.	Mini MK15	2079	I	HP	.22		X		0.50	1037		15K
		——	I	HP	.38		X		1.45	891		15K
		2080	I	HP	.22	X			0.65	1069		15K
		2096	I	HP	.38	X			1.30	890		15K
	Mini Protector	2081	IIA	HP	9mm		X		1.30	1084		20K
		——	IIA	HP	.357		X		1.30	1289		20K
		2062	IIA	HP	9mm	X			1.40	1053		20K
		2097	IIA	HP	.357	X			1.60	1297		20K
	Mini Protector	2093	II	HP	.357	X			1.65	1367		20K
		2094	II	HP	9mm	X			1.50	1148		20K
		2095	II	HP	9mm		X		1.25	1142		20K
		2083	II	HP	.357		X		1.55	1418		20K
	Mini Protector/ Steel Insert	2084	III	HP	7.62		X		0.00	2624		K with steel insert
Magnum Armor	1000	1921	I	HP	.38	X			2.30[1]	898	2	12K
		2054	I	HP	.22		X		0.75	1073		12K
		——	I	HP	.38		X		1.30	876		12K
		2055	I	HP	.22	X			0.60	1036		12K
	2000	2057[2]	II	D	.357		X		1.73	1445		18K
Norton Co.	FSN8470-926-1574	2058	IV	HP	30.06	X				2748		Unknown
		2059	IV	HP	30.06		X			2766		Unknown
Point Blank Body Armor	10	1911	I	HP	.38	X			1.60	898		10K
		2047	I	HP	.22	X			0.60	1021		10K
		2046	I	HP	.38		X		1.60	873		10K
		——	I	HP	.22		X		0.90	1035		10K
	15	2044	IIA	D	9mm		X		1.38	1072		17K
		——	IIA	D	.357		X		1.61	1206		17K
		2045	IIA	D	9mm	X			1.38	1123		17K
		——	IIA	D	.357	X			1.67	1297		17K
	20	1912	II	HP	.357		X		1.80[1]	1383	2	16K

[1] Deformation is greater than 1.73 inches allowed by NILECJ STD-0101.01
[2] Dry Test only

SUMMARY OF BALLISTIC TEST DATA (Continued)

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material in Vest (K-Kevlar N-Nylon)
Progressive Apparel Co.	ES8	2016	I	HP	.22		X		1.05	1060		8K
		——	I	HP	.38		X		1.60	896		8K
		2017	I	HP	.22	X			0.85	1031		8K
		1903	I	HP	.38	X			1.80[1]	899	1	8K
	ES15	1922	IIA	HP	9mm		X		1.35	1133		15K
		——	IIA	HP	.357		X		1.55	1212		15K
		1923	IIA	HP	9mm	X			1.45	1188		15K
		——	IIA	HP	.357		X		1.60	1283		15K
		1928	IIA	HP	9mm	X			1.45	1094		15K
		1926	IIA	HP	.357	X		X	——	1291	1	15K
	ES23	1904	II	D	9mm	X			1.32	1182		23K
		——	II	D	.357	X			1.51	1438		23K
		1905	II	D	9mm		X		0.95	1136		23K
		——	II	D	.357		X		1.53	1373		23K
Protective Apparel Corp. of America	PGC-10	2050	I	D	.22		X		0.81	1073		10K
		——	I	D	.38		X		1.51	875		10K
		2051	I	D	.22	X			0.82	1053		10K
		——	I	D	.38	X			1.52	864		10K
	PGC-10(F)	1919	I	HP	.22	X			0.55	1030		10K
		——	I	HP	.38	X			1.65	877		
		——	I	HP	.22		X		0.90	1068		10K
		——	I	HP	.38		X		1.60	897		10K
	PGC-18	2052	IIA	HP	9mm		X		1.20	1128		18K
		——	IIA	HP	.357		X		1.30	1264		18K
		2053	IIA	HP	9mm	X			1.25	1084		18K
		1906	IIA	HP	.357	X			1.40	1239		18K
	PGC-18(F)	1920	IIA	HP	9mm		X		1.20	1154		18K
		1924	IIA	HP	.357		X		2.10[2]	1255	2	18K
	PGC-20	1925	II	HP	.357	X		X	——	1420	1	20K
		1915	II	HP	9mm		X	X	——	1182	5	20K
	PGC-22	1916	II	HP	9mm		X		1.10	1143		22K
		1916A	II	HP	.357		X	X	——	1443	3	22K
	PGC-1	2048	II	D	9mm	X			1.02	1208		27K
		——	II	D	.357	X			1.49	1429		27K
		2049	II	D	9mm		X		1.12	1215		27K
		——	II	D	.357		X		1.51	1418		27K

[1] Deformation is greater than 1.73 inches allowed by NILECJ STD-0101.01

[2] Deformation is greater than 1.73 inches allowed by NILECJ STD-0101.01. Deformation occurred on impact over bust area unsupported by clay backing.

SUMMARY OF BALLISTIC TEST DATA (Continued)

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material in Vest (K-Kevlar N-Nylon)
Protective Materials Co., Inc.	Featherflex	2067	I	HP	.22		X		0.97	1110		8K
		——	I	HP	.38		X		1.50	848		8K
		2067A	I	HP	.38	X			1.60	834		8K
		2066	I	HP	.22	X			1.00	1075		8K
	Not Designated	2071	IIA	HP	9mm		X	X	——	1078	2	14K
	Not Designated	2068	II	HP	9mm		X		1.60	1144		19K
		——	II	HP	.357		X		1.55	1370		19K
		2069	II	HP	9mm	X		X	——	1165	2	19K
	PA500	2072	IV	HP	30.06		X		0.00	2701		Unknown
		——	IV	HP	30.06		X		0.00	2727		Unknown
		2073	IV	HP	30.06		X		0.30	2769		Unknown
		——	IV	HP	30.06		X		0.00	2773		Unknown
	PA500AP	2074	IV	HP	30.06		X		0.85	2776		Unknown
Safariland Ballistics, Inc.	M1-2W	2000	I	D	.22		X		0.56	1056		12K-8 Plastic
		——	I	D	.38		X		1.17	875		12K-8 Plastic
		2001	I	D	.22	X			0.48	1020		12K-8 Plastic
		——	I	D	.38	X			1.15	846		12K-8 Plastic
	M2-2W	2002	IIA	D	9mm	X			1.08	1095		20K-8 Plastic
		——	IIA	D	.357	X			1.49	1264		20K-8 Plastic
		2003	IIA	D	9mm		X		1.22	1138		20K-8 Plastic
		——	IIA	D	.357		X		1.25	1241		20K-8 Plastic
	M2A-2W	2004	II	HP	9mm		X		0.70	1134		24K-8 Plastic
		——	II	HP	.357		X		1.45	1367		24K-8 Plastic
		2005	II	HP	9mm		X		1.05	1131		24K-8 Plastic
		2099	II	HP	.357	X			1.50	1364		24K-8 Plastic
		2098	II	HP	9mm	X		X	——	1164	3	24K-8 Plastic
	M3-2W	2006	II	D	9mm		X		1.03	1172		24K-8 Plastic
		——	II	D	.357		X		1.33	1475		24K-8 Plastic
		2007	II	D	9mm	X			1.03	1219		24K-8 Plastic
		——	II	D	.357	X			1.37	1368		24K-8 Plastic

SUMMARY OF BALLISTIC TEST DATA (Continued)

Manufacturer of Armor	Model No.	IACP No.	Threat Level Tested	Test Lab.	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (Inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material In Vest (K-Kevlar N-Nylon)
Second Chance Body Armor, Inc.	X	2064	I	D	.22		X		0.70	1089		3N-8K-3N
		——	I	D	.38		X		1.25	85[illegible]		3N-8K-3N
		2065	I	D	.38	X		X	——	[illegible]61	1	3N-8K-3N
	Y	2062	IIA	HP	.357		X		1.70	1240		18K
		——	IIA	HP	.357	X			2.00[1]	1215	1	18K
		2063	IIA	HP	9mm		X		1.60	1135		18K
	Z	2061	II	D	.357		X		2.05[1]	1354	1	26K
Technipol International Corp.	KXX+1	1929	II	HP	9mm	X			1.40	1137		18K
		——	II	HP	.357		X		1.60	1392		18K
		2039	II	HP	9mm		X		0.93	1132		18K
		——	II	HP	.357		X		1.30	1370		18K

[1] Deformation is greater than 1.73 inches allowed by NILECJ STD-0101.01

SUMMARY OF THE STANDARD

BALLISTIC RESISTANCE OF POLICE BODY ARMOR (NILECJ-STD-0101.01)

The protection afforded by body armor depends on its ability to resist penetration by bullets and to minimize injury due to sudden deformation of the armor. Overall protection afforded by the armor depends on its configuration. Some body armor configurations protect only the torso of the wearer. Others also protect the torso back, the groin, and the coccyx (lower spine) areas. The ability of any body armor component to resist penetration depends not only on its materials and construction, but also on the characteristics of the bullet: its material, shape, weight, and velocity.

IMPORTANT THINGS TO CONSIDER IN USING THIS STANDARD

The standard classifies body armor by type and by configuration. The purchaser should determine and specify in the procurement documents which type and which configuration is required, referring to the detailed information provided in the standard.

A suggested example of the wording of a typical purchase order could be:

> *The body armor shall meet all requirements of NILECJ-STD-0101.01, "Ballistic Resistance of Police Body Armor," shall be of Type .357 Magnum, as defined in Threat Level IIA of that standard, and shall afford protection to the torso front, torso back, and sides.*

Other characteristics of body armor not addressed by the standard, such as size, weight, launderability, water repellancy, and type of fasteners, should be evaluated in terms of what is available and specified in the procurement documents.

TYPES OF TESTS

The following is a simplified summary of the types of tests and the conditions required for testing the performance of body armor. All five types of body armor are tested for penetration resistance and impact deformation. The difference among the five types involves the amount of energy the armor is subjected to by the test bullets or the weight of the bullet and its velocity. The weight of the bullet is known, and the velocity is measured during the test. The bullet fired at the test armor passes through two detection devices which are connected to a highly accurate clock (chronograph) that measures the elapsed time from the moment the bullet passes through the "ON" trigger (the detector that starts the clock) to the moment the bullet passes through the "OFF" trigger (the detector that stops the clock). Since the distance between these two detectors is accurately measured, the velocity of the bullet can be easily calculated. The purpose of this instrumentation is to verify that the bullet's velocity is within the range specified in the standard.

BALLISTIC PENETRATION TEST

A block of nonhardening, oil-base modeling clay 18" x 18" x 4" in size is placed in contact with the backside of the armor test specimen during ballistic testing. The backing material is conditioned and maintained to a specified consistency. For all types of armor, the torso front of the armor under test is hit with the specified number of "fair hits" spaced apart as evenly as possible to test all portions. (Each part of armor designed to resist penetration by 30-06 ammunition is tested for only one hit since these armors, in general, may not afford full protection after being impacted once.)

The armor meets ballistic requirements of the standard if there is no complete perforation of an armor test sample by a bullet or by a fragment of the bullet or armor, as evidenced by the presence of that bullet or a fragment in the backing material, or by a hole which passes through the backing material.

BALLISTIC DEFORMATION TEST

This test is identical to the ballistic penetration test, except that after the first two fair hits resisting penetration, the deformation block is separated from the armor and the dimensions of the depressions in the clay caused by the armor deformation are measured. The ballistic deformation requirement of the standard is met if the deformation depth is not greater than 44 mm (1.73 in.).

RECOMMENDATIONS

The programs of ETC all share the common purpose of providing criminal justice administrators, planners, and other interested consumers with timely information about equipment, products, and the current state of equipment-related research and development. The programs also emphasize the testing, evaluation, and, where necessary, the improvement of presently available equipment considered critical to law enforcement and criminal justice.

NILECJ Standard 0101.01 requires that all armor shall be clearly and durably marked to provide the following information for the user:

- Identification of manufacturer
- Type of body armor (threat level for which designed)
- Date of manufacture
- Size
- Lot number, month and year of manufacture, or serial number
- Strike face, if any
- Cleaning instructions for the ballistic material and the carrier

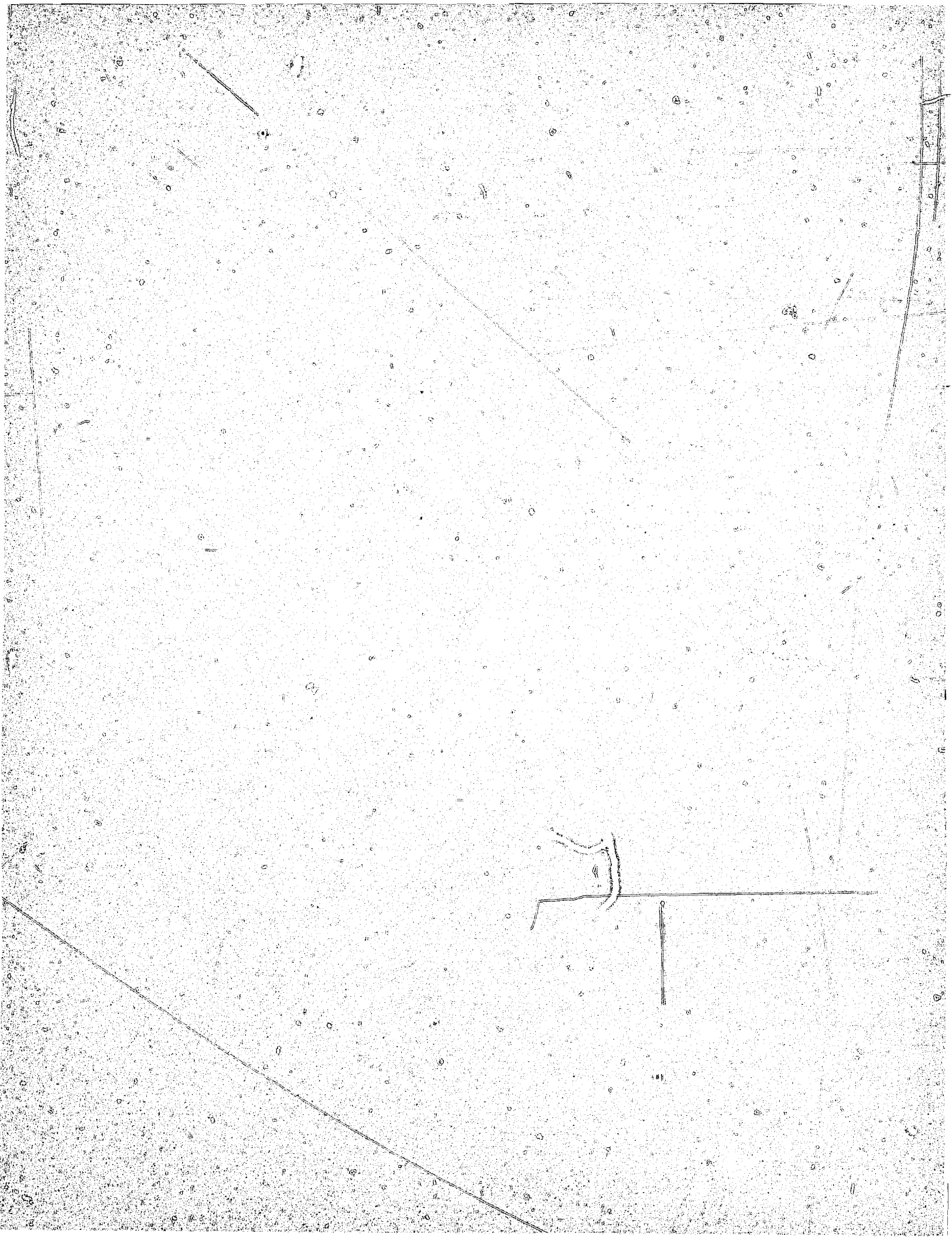
With very few exceptions, the police body armor tested failed to comply with this labeling requirement.

We recommend that purchasers demand that:

1. Armor be labeled by the manufacturers in accordance with the NILECJ standard.
2. Ballistic capability and wearability factors appear on the armor.
3. Manufacturer is identified by company name in addition to model designation or slogan.
4. Manufacturer's mailing address appears on the article.

It is hoped that this body armor testing program will provide information to assist the user in making body armor purchasing decisions and also serve to upgrade equipment manufacturing.

And, equally important, from it may come the impetus and encouragement for manufacturers to continuously update, test, and make available improved equipment in this product area so critical to law enforcement operations.



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Police Body Armor
Consumer Product Report

Supplement No. 1
January 1979

Subsequent to the publication of the initial *Police Body Armor Consumer Product Report* by the International Association of Chiefs of Police in December 1978, additional body armor models have been tested in accordance with the requirements and procedures of NILECJ-STD-0101.01, "Ballistic Resistance of Police Body Armor." Reports of tests conducted at the H. P. White, Inc. testing laboratory are summarized in this supplement. Complete test data can be obtained upon request to the IACP Equipment Technology Center.

This supplement should be affixed to one of the blank pages of the *Police Body Armor Consumer Product Report* to maintain the report in current status. Additional supplements will be issued periodically. Also, you may contact the IACP Equipment Technology Center at any time to insure that you have received the latest body armor test data available.

SUMMARY OF BALLISTIC TEST DATA

Manufacturer of Armor	Model No.	Threat Level Tested	Test Ammo Used	Wet Test	Dry Test	Penetration	Deformation (inches)	Muzzle Velocity (Ft./Sec.)	Shot Sequence	Ballistic Material in Vest (K-Kevlar N-Nylon)
Protective Materials Co., Inc.	Standard Flex IIA	IIA	.357		X		1.50	1290		7K (Single)
			9mm		X		1.15	1111		3K (Double)
			.357	X			1.50	1279		1K (Impregnated)
			9mm	X			1.10	1147		
	Standard Flex II	II	.357		X		1.50	1352		12K (Single)
			9mm		X		1.20	1162		3K (Double)
			.357	X			1.40	1390		1K (Impregnated)
			9mm	X			1.30	1163		

The above submitted garments were found to be in full compliance with NILECJ-STD-0101.01.

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END