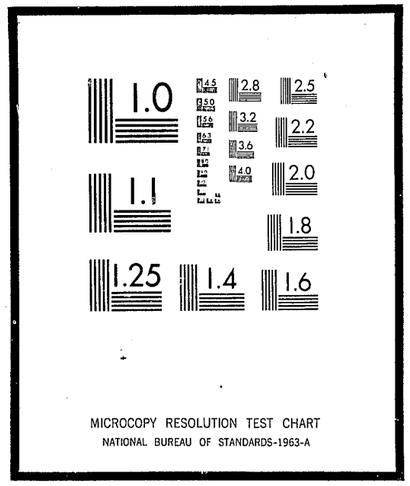

WASHINGTON OPERATIONS

DETAILED OPERATIONAL REQUIREMENTS PROTECTIVE GARMENTS FOR LAW ENFORCEMENT AGENCIES

October 1973

Equipment Systems Improvement Program Report
prepared for

NILE&CJ

U.S. DEPARTMENT OF JUSTICE
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
NATIONAL INSTITUTE OF LAW ENFORCEMENT
AND CRIMINAL JUSTICE

MITRE

THE EQUIPMENT SYSTEMS IMPROVEMENT PROGRAM

Following a Congressional mandate* to develop new and improved techniques and equipment to strengthen law enforcement and criminal justice, the National Institute of Law Enforcement and Criminal Justice under the Law Enforcement Assistance Administration of the Department of Justice established the Equipment Systems Improvement Program. The objectives of the Program are to determine the priority needs of the criminal justice community to help in its fight against crime, and to mobilize industry to satisfy these needs. A close working relationship is maintained with operating agencies of the criminal justice community by assigning systems analysts to work directly within the operational departments of police, courts and corrections to conduct studies related to their operational objectives.

This document is a research report from this analytical effort. It is a product of studies performed by systems analysts of the MITRE Corporation, a not-for-profit Federal Contract Research Center retained by the National Institute to assist in the definition of equipment priorities. It is one of a continuing series of reports to support the program decisions of the Institute relative to equipment development, equipment standardization and application guidelines. Comments and recommendations for revision are invited. Suggestions should be addressed to the Director, Advanced Technology Division, National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U. S. Department of Justice, Washington, D. C. 20530.

Gerald M. Caplan, Director
National Institute of Law
Enforcement and Criminal Justice

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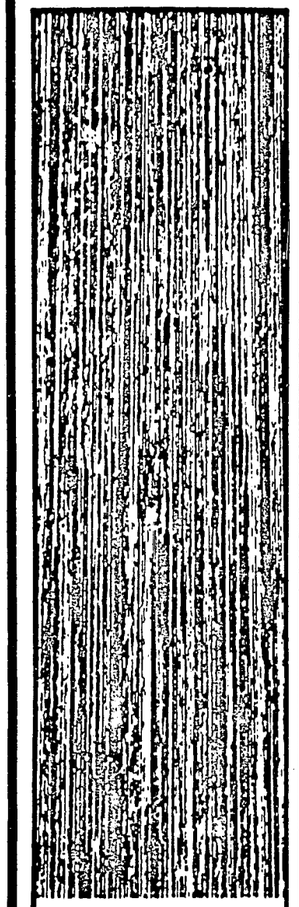
* Section 402(b) of the Omnibus Crime Control and Safe Streets Act of 1968, as amended.



THE MITRE CORPORATION
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Subject: Detailed Operational Requirements for Protective Garments for Law Enforcement Agencies

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ABSTRACT

Operational requirements for flexible protective garments are presented in terms of general requirements, weapon threat, physical mobility, and comfort and appearance. The minimum level of protection for the basic weapon, the .38 caliber handgun, is specified, as well as desired levels of protection for other weapons. Protection requirements are stated in terms of wearer incapacitation and areas of the body to be protected. The requirements for physical mobility and comfort are expressed in terms of the environments in which they are expected to operated.

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GLOSSARY

Ballistic impact - The violent contact of a blunt instrument upon another body, specifically, the striking of a bullet upon a person or thing.

Ballistic resistance - The resistance of a protective garment to penetration by a ballistic impact.

Blunt trauma - The bodily injury resulting from a ballistic impact that does not necessarily involve a penetration of the surface.

Body armor - Garments that have an inherent resistance to penetration by impact of blunt instruments (see protective garments).

Flexible protective garments - Same as "protective garments."

General requirements - Requirements that relate specifically to organizational and procedural needs of the user.

Incapacitation - To make incapable of normal activity or response.

Operational requirements - Requirements that relate specifically to the operational needs of the user as opposed to those that relate to the technical design needed to meet the operational requirements.

Protection - The reduction in the degree of physical injury resulting from assault with a deadly weapon.

Protective garments - Body armor that exhibits wearability properties similar to conventional clothing (see body armor).

Routine duties - Duties attendant to a regular assignment, not requiring a special assignment.

Service weapon - The weapon routinely carried by a law enforcement officer; usually refers to the weapon specified by the organization but may refer to the weapon routinely carried by an individual officer.

Uniform component - An article of clothing that is part of a uniform.

SECTION I

INTRODUCTION

This document contains the operational requirements for flexible protective garments for law enforcement use. The purpose of the protective garments is to reduce the effect of the physical assault of law enforcement officers during the performance of routine duties. The garments are not a replacement for body armor of the type currently used by tactical units during control of sniper action. They are to be worn during routine duty by male and female officers and are designed not to impede the officer in the performance of duty.

A companion document, WP 10419, contains a collection of firearms incident data and uniform data from which the requirements for the protective garment were derived. These data show that it has not been uncommon for an officer to be assaulted with his own service weapon. It is suggested that caution be exercised in the use of the garment in those agencies in which the service weapon falls outside the characteristics defined in this document and whose experience shows a high percentage of service weapon related attacks.

SECTION II

GENERAL REQUIREMENTS

GARMENT CONFIGURATION

The general intent of flexible protective garments is to serve as a part of the police officer's regular clothing while at the same time protecting him from death or incapacitation due to firearms attack. Several garment configurations may be employed, ranging from a single garment to a set of garments. The protective garment may be a garment designed solely for protection, such as a protective undershirt or vest, or it may be a component of a normal uniform to which protective features have been added.

FUNCTIONAL APPLICATION

The garment shall provide the protection specified herein with a minimum of interference to the wearer in the performance of his duty in the following functional applications:

- mobile patrol
- foot patrol
- detective
- undercover agent
- prison guard
- courtroom bailiff

LABELING

A label shall be provided in the garment which clearly specifies the limits of protection provided by the garment. This label shall also include any precautionary notice applicable to the use and maintenance of the garment.

A label shall also be provided in the garment which identifies the manufacturer, the size of the garment and the model number. All garments shall be given a serial number for quality control purposes which shall be included in the label. The protection label may be combined with the manufacutrer's label.

SECTION III

LEVEL OF PROTECTION

BASIC WEAPON

The protective garment shall provide protection against the following basic weapon configuration:

.38 Caliber Special Handgun (Revolver)

Ammunition

Type - Semi-jacketed, hollow point
Weight - 125 grains

Remington Catalog No. 2038 or equivalent

Bullet Characteristics

Maximum muzzle velocity - 1,370 ft./second
Maximum muzzle energy - 520 ft. pounds

ADDITIONAL FIREARMS

The goal shall be to provide at least as much protection as for the .38 caliber weapon against the following weapon configurations:

.22 Caliber Handgun

Ammunition

Type - Soft point
Weight - 40 grains

Remington Catalog No. 0122 or equivalent

Bullet Characteristics

Maximum muzzle velocity - 2,100 ft./second
Maximum muzzle energy - 390 ft. pounds

.32 Caliber Handgun

Ammunition

Type - Metal case
Weight - 71 grains

Remington Catalog No. 2632 or equivalent

Bullet Characteristics

Maximum muzzle velocity - 960 ft./second
Maximum muzzle energy - 145 ft. pounds

9 mm Automatic

Ammunition

Type - Jacketed, hollow point
Weight - 115 grains

Bullet Characteristics

Maximum muzzle velocity - 1,160 ft./second
Maximum muzzle energy - 345 ft. pounds

The weapons specified above may be fired at any distance (including point blank range) from the wearer of the garment. The bullet may strike the protected area at any angle of incidence to the impact point.

CUTTING INSTRUMENTS

A garment designed to withstand the threat of the basic weapon as defined in a previous paragraph is expected to have an inherent resistance to cutting instruments (knives, broken bottles, razors, etc.). The protection provided to cutting instruments shall be measured and specified as part of the performance of the garments. Since the firearm is the most often employed assault weapon and inflicts the more severe injuries, the design requirements are built around the firearm threat.

SECTION IV

PROTECTION REQUIREMENTS

The protection afforded to the wearer of a garment to the threats specified in Section III are as follows:

BALLISTIC RESISTANCE

The protective garment shall not allow penetration of a bullet through the inside layer (closest to the wearer's body) of the protective material.

BLUNT TRAUMA RESISTANCE

The wearer of the garment shall not suffer irreparable body damage as a result of blunt trauma induced by the ballistic impact on the protected area. Irreparable body damage shall be defined as impairment of body function or body organ which cannot be surgically or medically repaired. Simple scarring or other minor skin damage shall not be considered as irreparable body damage.

WEARER INCAPACITATION

The wearer shall not lose consciousness following a ballistic impact in the protected area. The impact shall not prevent the wearer from physically reacting to a continued assault by means such as drawing his weapon, moving away from the initial line of fire or calling for assistance.

AREA OF PROTECTION

The garment shall provide protection to the wearer in the following body areas: (Figure 1)

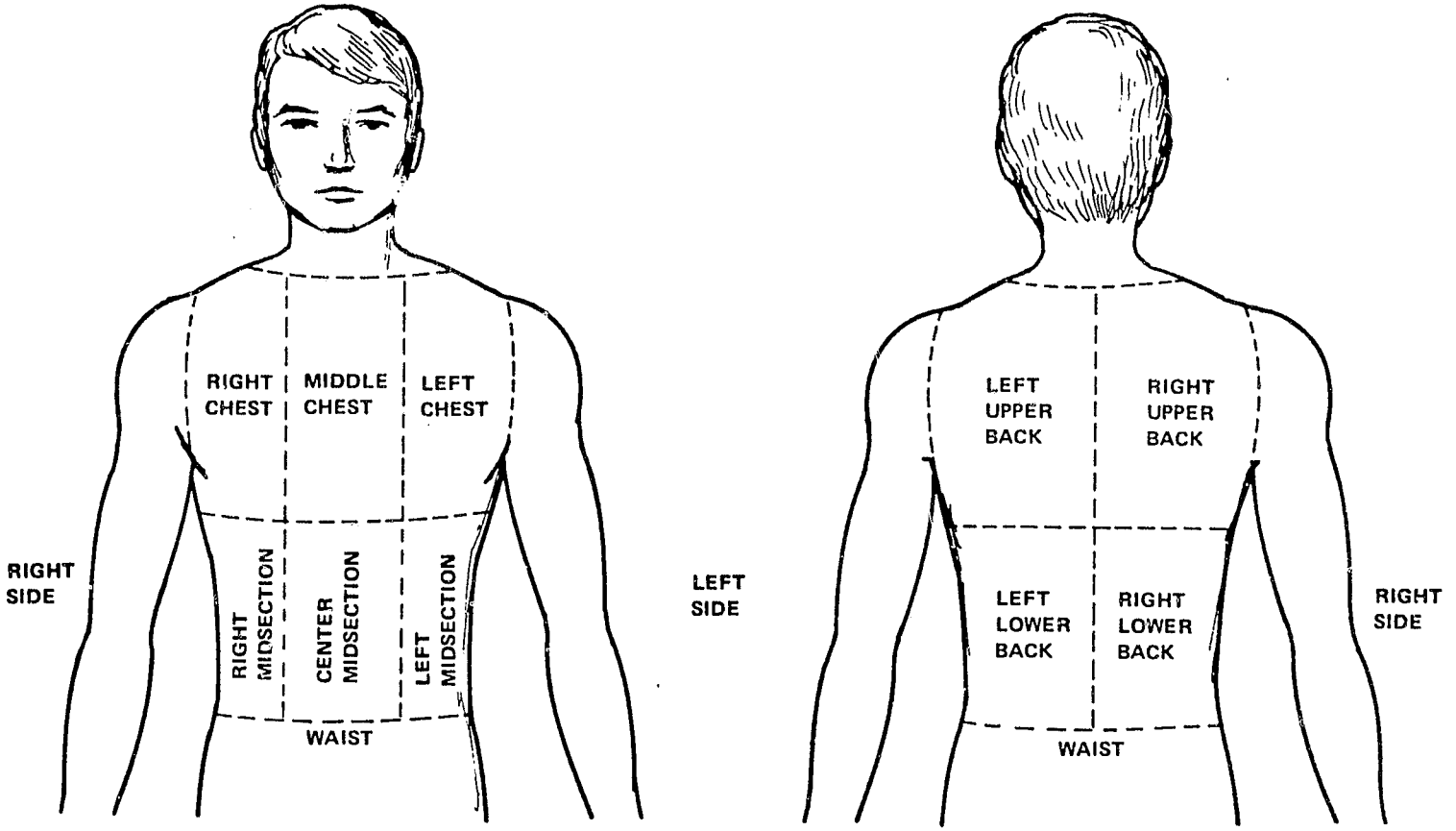

FIGURE 1
AREAS OF THE BODY TO BE PROTECTED

- Left chest
- Middle chest
- Right chest
- Left midsection, above waist
- Center midsection, above waist
- Right midsection, above waist
- Left upper back
- Right upper back
- Left lower back, above waist
- Right lower back, above waist
- Right side
- Left side

SECTION V

PHYSICAL MOBILITY REQUIREMENTS

The garment shall not impede by more than the minimum conditions specified below, the performance of normal duties of the wearer. The following specific areas were chosen to provide a measure of the degree of minimum impediment of the protective garments on the physical mobility of the wearer. These requirements are based on users in good physical condition in the age group between 20-40 years. All requirements are based on the comparative performance of a subject when wearing the protective clothing and wearing the equivalent regular clothing.

1. Running

The time to run a mile shall not be affected by more than five percent due to the wearing of the garment, through all climatic and seasonal conditions.

2. Rope Climbing

The time for a subject to climb a gymnasium-type rope (20 feet in length) shall not be affected by more than five percent due to the wearing of the garment.

3. Drawing Weapons

The time to draw a weapon shall not be affected due to the wearing of the garment. This shall be based on the use of an unconcealed holster as part of the normal uniform.

4. Other Physical Mobility

The garment shall afford the wearer complete freedom of movement. There shall be no restraint on a subject's capability to maneuver, especially in applying physical effort to apprehend a resisting offender.

SECTION VI

COMFORT AND APPEARANCE REQUIREMENTS

COMFORT

The protective garment is intended to be worn full time during normal tours of duty and, therefore, should be comfortable in order not to discourage its use.

The garment shall not be abrasive, itchy, stifling, binding or in any way a source of mechanical discomfort to the wearer.

CLIMATE

The protective garment shall meet the performance and comfort requirements when worn continuously at a temperature of 75°F or below with relative humidity of 60 percent or below. For temperature and relative humidities in excess of these values, the period of wear is reduced as shown in Table 1.

The protective garments shall meet all comfort requirements when worn in cold temperatures of -10°F for sustained periods. The following specific requirements apply:

- There shall be no more than a ten percent increase in the degree of brittleness or inflexibility at any temperature as compared to that at 75°F.

- There shall be no more than a five percent increase in the level of surface roughness of material, compared to that at 75°F.

- There shall be no more than a five percent decrease in the tensile strength of the material or the stitching within the garment compared to that at 75°F.

TABLE I

ENVIRONMENTAL COMFORT UTILITY OF GARMENT

TEMPERATURE (°F)	RELATIVE HUMIDITY (%) 50	60	70	80	90	100
70-75	100	100	100	100	100	100
75-80	100	100	95	95	90	90
80-85	95	90	85	85	80	75
85-90	85	80	80	75	70	65
90-95	80	70	65	60	50	40
95-100	60	50	40	30	-	-
ABOVE 100	40	20	-	-	-	-

Numbers on chart refer to the minimum percentage of an eight-hour duty tour during which the garment can be worn with comfort when the temperature and/or humidity equal or exceed the coordinate values throughout the duty tour, assuming no air conditioning.

APPEARANCE

Protective uniform components, when worn in a normal manner, shall not exhibit an outward appearance of being different from the same uniform component without the protective feature. In particular, the protective character of the uniform component or the fact that a protective garment is being worn shall not be obvious to a casual observer.

All protective garments shall be neat in appearance when worn and shall be able to comply with the normally accepted dress regulations of law enforcement agencies.

UNIFORM STANDARDS

The styling, creasing, collar formation, stitching, and other general neatness requirements specified by police departments in their clothing and uniform standards shall apply to protective garments.

SECTION VII

SERVICEABILITY AND MAINTENANCE REQUIREMENTS

AGING

Aging of the material shall not affect the protective qualities of the garment for at least ten years after manufacture. The date of manufacture shall be marked on the label of the garment.

MOISTURE

Wetness or dampening of the garment material, whether by spillage of liquids, perspiration, high humidity, etc., shall have no effect upon the protective qualities of the garment, as specified in Section IV.

TEMPERATURE

The protection requirements of Section IV shall be met over the temperature range of $-10^{\circ}F$ to $100^{\circ}F$.

AMBIENT AIR POLLUTANTS

All protective garment material shall be resistant to chemical materials found in the atmosphere as a result of environmental air pollution. There shall be no loss of protection as a result of exposure to urban environments.

SUNLIGHT

Direct sunlight shall not cause any deterioration of protective qualities of the garment.

FIRE/ELEVATED TEMPERATURES

All protective garment material shall be inert at the combustion temperature of cigars, cigarettes, matches and similar substances. In addition, the material shall withstand a temperature of $150^{\circ}F$ for 20 seconds without scorching, igniting, exploding or burning.

The measured ignition and flash point temperatures shall be documented by the manufacturer for any protective garment material employed in uniform components.

ABRASION

The materials used in protective garments shall resist mechanical abrasion to the degree normally required of conventional uniform components. The following areas of uniforms are particularly subject to abrasion:

- Badge and nameplate holders
- Pocket areas
- Knee and elbow areas
- Shoulder areas

BODY CONTACT SUBSTANCES

The protective qualities of the garment shall not be deteriorated by contact with normal substances which may come in contact with the garment. Examples of such substances are:

- Deodorants, lotions, talcum, hair tonics and other cosmetic preparations
- Perspiration
- Blood
- Soaps, etc.

POLICE CHEMICAL AGENTS

There shall be no deterioration of the protective quality of the garment as a result of exposure to the following substances:

- Gun cleaning or storing oils
- CN or CS type tear gases
- Chemical mace
- Gunpowder
- Gasoline or helicopter fuel
- Brass or silver cleaning polish

LAUNDERING AND DRY CLEANING

There shall be no reduction in protective quality incurred as a result of laundering or dry cleaning (as applicable), using conventional methods and practices as specified by the National Institute of Dry Cleaning and the American Institute of Laundering. The reduction in weight of a standard piece of protective garment material shall not exceed two percent after 25 wet washings and dryings in a conventional laundering machine and drying machine.

The retention of body odor in protective garments shall not be greater than exhibited by similar non-protective clothing after any conditions of wearing, washing and/or cleaning.

The retention of body stain and marking in protective garments shall be no greater in outward appearance than exhibited by similar clothing after any conditions of wearing, washing and/or cleaning.

There shall be no increase in the degree of bulkiness or protrusion in protective garment clothing components incurred as a result of laundering and/or dry cleaning. There shall also be no increase in the degree of stiffness of protective garment material as a result of laundering and dry cleaning.

The increase in the level of surface abrasiveness of protective garment material as a result of 25 wet washings or dryings or after ten dry cleaning cycles shall be minimal.

SHRINKAGE

There shall be no greater than three percent shrinkage of any protective garment incurred as a result of wear, exposure, laundering or dry cleaning. Shrinkage levels shall not be uneven, nor shall they be any more severe than that experienced with cotton or cotton/dacron polyester fabric material.

STITCHING

All clothing manufactured from protective garment material, including undergarments, shall exhibit tensile strength at the stitching areas comparable to that of clothing made from conventional fibers.

Shirts and undergarments made from protective garment material shall exhibit stitching at the seams of such quality that they will show not more than five percent unraveling at the end of a six-month period.

END