



# Ballistic-Resistant Body Armor for Women

## Focus Group Report

February 2020



**Homeland  
Security**

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## FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercially available equipment and systems and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use and maintain emergency response equipment

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” These knowledge products are shared nationally with the responder community, providing a life-and cost-saving asset to DHS, as well as to Federal, state and local responders.

The SAVER Program is managed by the National Urban Security Technology Laboratory (NUSTL). NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, coordinating with other organizations and ensuring flexibility and responsiveness to first responder requirements.

NUSTL provides expertise and analysis on a wide range of key subject areas, including chemical, biological, radiological, nuclear, and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation, and technologies. In support of this tasking, NUSTL will conduct a comparative assessment of ballistic-resistant body armor for women to provide emergency responders with reference information on currently available technologies. Ballistic-resistant body armor falls under AEL reference number O30E-01-VSTO titled vests, operational. As part of the project, assessment recommendations were gathered from a focus group and are documented in this report.

For more information on NUSTL’s SAVER Program or to view additional reports on body armor or other technologies, visit [www.dhs.gov/science-and-technology/SAVER](http://www.dhs.gov/science-and-technology/SAVER).

**U.S. Department of Homeland Security**



System Assessment and Validation for Emergency Responders

## POINT OF CONTACT

National Urban Security Technology Laboratory (NUSTL)  
U.S. Department of Homeland Security  
Science and Technology Directorate  
201 Varick Street  
New York, NY 10014

E-mail: [NUSTL@hq.dhs.gov](mailto:NUSTL@hq.dhs.gov)

Website: [www.dhs.gov/science-and-technology/SAVER](http://www.dhs.gov/science-and-technology/SAVER)

Author:

Gladys Klemic, Physicist

NUSTL Focus Group Team:

Kris Dooley

Claire Gutekanst

Karin Decker

Brenda Velasco-Lopez

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## EXECUTIVE SUMMARY

Through its System Assessment and Validation for Emergency Responders (SAVER) Program, the National Urban Security Technology Laboratory (NUSTL) will conduct a comparative assessment of commercially available ballistic-resistant body armor for women to provide emergency responders with information that will assist with making operational and procurement decisions. In September 2019, as a part of the assessment planning process, NUSTL convened a focus group of six female responders from various jurisdictions who use ballistic-resistant body armor, with the objective of obtaining their expert recommendations for evaluation criteria, product selection, and operational scenarios. These recommendations are documented in this report.

Ballistic-resistant body armor is worn by law enforcement officers and some emergency medical responders to increase their safety while on routine duty or during special operations. Body armor is designed to protect vital organs in the torso from specific ballistic threats during incidents involving firearms. With women's presence in law enforcement steadily increasing, body armor is being optimized specifically for the female physique.

This SAVER project focuses on products that provide ballistic protection from handguns. Tactical armor—that provides protection from rifle rounds—is not currently designed specifically for women and is beyond the scope of this effort. Ballistic-resistant body armor for women falls under the Authorized Equipment List reference number O30E-01-VSTO titled vests, operational.

Focus group participants identified 21 evaluation criteria by which the body armor could be assessed. They grouped these criteria into five categories (affordability, capability, deployability, maintainability and usability) and concluded that usability and capability were the most important categories, followed by deployability, maintainability and affordability, respectively.

The focus group also assigned a weight for each criterion's level of importance and identified seven criteria of utmost importance, i.e., they would not purchase ballistic-resistant body armor that did not meet their expectations for that criteria. Those that were considered of utmost importance included belt and vest compatibility, comfort, cup size, fit measurement process, female design fit, non-prohibitive movement and closure direction. Focus group participants outlined possible operational scenarios for conducting the assessment, which included donning and doffing, performing surveillance, use of a patrol car, physical training and defensive tactics and use of various weaponry. They recommended that the scope of the assessment should focus primarily on concealable body armor certified for ballistic protection level IIIA and suggested that exterior vests could be a secondary aspect of the assessment, contingent on their availability for the concealable products selected.

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## 1.0 INTRODUCTION

Ballistic-resistant body armor is worn by law enforcement officers to increase their safety while on routine duty or during special operations. Body armor is designed to protect vital organs in the torso from specific ballistic threats during incidents involving firearms. With women's presence in law enforcement steadily increasing, body armor is being optimized specifically for the female physique.

In September 2019, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a focus group of experienced users of ballistic-resistant body armor for women. The purpose of this focus group was to obtain information about users' professional and practical experiences that are relevant to operational decisions and procurement selections. The information provided by this focus group will be the basis of a future SAVER assessment<sup>i</sup> of commercially available ballistic-resistant body armor that is designed to fit women.

### 1.1 PARTICIPANT INFORMATION

Six female emergency responders from various jurisdictions and with at least three years of experience using ballistic-resistant body armor participated in the focus group.

Table 1-1 Focus Group Participant Demographics

Practitioner	Years of Experience	State
Law Enforcement/Federal Investigation (Retired 2016)	30+	IL
Law Enforcement/Traffic Control	15–20	IL
Law Enforcement/Canine Unit	15–20	MA
Special Agent/Protective Service	10–15	NY
Law Enforcement/Transit Police/Counterterrorism	5–10	NY
Special Agent/Protective Service/Aviation	< 5	NY

<sup>i</sup> The assessment date is contingent on pending release of the updated ballistic resistant body armor performance test standard. See section 2.0

## 2.0 FOCUS GROUP METHODOLOGY

The focus group opened with a description of the SAVER Program and the goals for the focus group meeting. This was followed by an overview of ballistic-resistant body armor technology and considerations of armor specifically designed for the female physique. The program manager (PM) for the National Institute of Justice (NIJ) Compliance Testing Program (CTP) discussed laboratory performance testing, which is conducted to certify compliance with the federal standard for ballistic protection [1] and included a sample of body armor subjected to compliance testing showing an embedded handgun round that was stopped by the ballistic material (Figure 2-1). The NIJ CTP PM also highlighted new test specifications that will address body armor designed for women and are included in a pending update to the NIJ ballistic armor performance test standard, which is expected to be published in 2020. To address unique features of body armor for women, the revised standard will include additional specifications to account for potential weak points at armor seams and will increase the number of armor panel samples to be tested to provide adequate testing statistics for curved front panels.



**Figure 2-1 Deconstructed Ballistic Armor Sample Provided by NIJ for Illustration**

Once the background material was covered, the NUSTL project leader facilitated focus group discussions to determine four sets of recommendations:

- 1) Evaluation criteria recommendations—Specific features that are important factors to consider when making equipment selection or operational decisions.
- 2) Assessment scenario recommendations—Operational settings and activities that would provide evaluators with appropriate conditions and opportunities to experience and evaluate the criteria.
- 3) Product selection criteria recommendations—Specifications, attributes or characteristics that a product should possess to be considered for the assessment.
- 4) Product recommendations—Specific brands or models (if any) that are especially relevant to the emergency responder community and should be candidates for inclusion in the comparative assessment.

Figure 2-2 highlights the process followed to gather these recommendations.

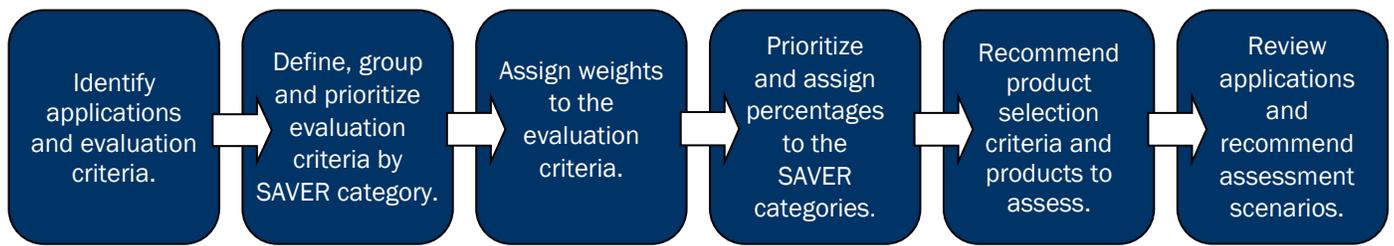


Figure 2-2 Focus Group Process

The focus group participants were asked to identify and define body armor characteristics appropriate for assessment evaluation criteria, which were then sorted into five SAVER categories:

- **Affordability** groups criteria related to the total cost of ownership over the life of the product. This includes purchase price, training costs, warranty costs, recurring costs and maintenance costs
- **Capability** groups criteria related to product features or functions needed to perform one or more responder relevant tasks
- **Deployability** groups criteria related to preparing to use the product, including transport, setup, training and operational/deployment restrictions
- **Maintainability** groups criteria related to the routine maintenance and minor repairs performed by responders, as well as included warranty terms, duration and coverage
- **Usability** groups criteria related to ergonomics and the relative ease of use when performing one or more responder relevant tasks.

Once the evaluation criteria were sorted within the SAVER categories, focus group participants assigned a weight for each criterion’s level of importance on a 1-to-5 scale within that category, where 5 is of utmost importance and 1 is of minor importance. The group then reviewed and refined the criteria, categories and relative weights. Table 2-1 summarizes the SAVER evaluation criteria weighting scale.

Table 2-1 Evaluation Criteria Weighting Scale

Weight	Definition
5	The evaluation criterion is of utmost importance. I would never purchase a product that does not meet my expectations for this feature.
4	The evaluation criterion is very important. I would strongly prefer to purchase a product that meets my expectations for this feature.
3	The evaluation criterion is important. I would have a moderate preference for purchasing a product that meets my expectations for this feature.
2	The evaluation criterion is moderately important. I somewhat prefer to purchase a product that meets my expectations for this feature.
1	The evaluation criterion is of minor importance. Meeting my expectations for this feature has little or no influence on my decision to purchase a product.

After each of the evaluation criteria were assigned a weight, the focus group participants recommended whether the criteria should be assessed operationally or according to vendor-provided specifications. Next, the focus group participants ranked the SAVER categories in order of importance and assigned a percentage corresponding to its relative level of importance.

After rating the SAVER categories, focus group participants identified product selection criteria and provided recommendations for defining the scope of the assessment. Lastly, the focus group recommended operational scenarios and specific activities for the assessment that would address each of the evaluation criteria under realistic operational conditions.

## 3.0 FOCUS GROUP DISCUSSION

The focus group participants discussed their professional experiences in wearing body armor, including practical challenges associated with body armor for women. Three participants brought the body armor they are currently using to the meeting, which allowed them to show key aspects of the armor and to demonstrate how it is worn. Having these tangible references helped illustrate and clarify the discussion, offered a sample set to compare some of the design variations currently available, and highlighted armor features that are associated with fit for women. During the discussion, the NIJ CTP PM provided supplemental information about commercial products and NIJ compliance requirements and showed a sample of ballistic material that had been subjected to testing.

The group discussion brought out many practical considerations of body armor features beyond the characteristics described in product specifications, performance standard metrics and guidance documents [2] [3]. These are elaborated on in the remainder of this section, as well as sections 4 and 7 and illustrated by photos in Figures 3-1 to 3-6.

### 3.1 KEY FEATURES

Body armor consists of ballistic-resistant front and back panels<sup>ii</sup> that are inserted into a fabric carrier, which holds the panels close to the torso. The panels are labeled to show which side must face out, away from the body. The carrier serves to position the panels to protect the torso and to overlap at the side of the body. In male and gender-neutral body armor, both the front and back panels are described as “planar,” meaning they are essentially flat. In female armor, the front panel is non-planar, meaning it has a three-dimensional structure to curve and fit around the bust line<sup>iii</sup>.



Figure 3-1 Various Styles for Feminine Shaping of Interior Ballistic Panels

<sup>ii</sup> In “soft armor,” the ballistic-resistant panel is constructed of several layers of woven polymer fibers, which are sealed in a non-removable waterproof casing. Soft armor is used in female body armor because it can be structured into a curved shape. Soft armor can provide protection against hand gun threats, while “hard armor” is designed for rifle threats. Hard armor may consist of ceramic or metallic plates and is not offered in female designs. The scope of this SAVER project is limited to soft armor.

<sup>iii</sup> The NIJ performance test required modifications to address non-planar designs. The number of product samples required to be sent for testing was doubled to provide equivalent test statistics for the curved front panel, and the testing shot pattern was adjusted to target potential weak spots at the front panel seams.

As shown in Figure 3-1, currently available female armor uses one of three different patterns to achieve a curved shape, some of which are similar to those used in women's apparel. In a three-piece design, two vertical seams centered on each breast connect a larger central section to panels on either side (sometimes called "princess seams" in women's apparel). In a two-piece design, a horizontal seam connects an upper panel that angles over the top of the bust to a flat lower panel to cover the lower half of the bust and abdomen. Another design uses sewn folds, or darts, to create a cup shape.

Another pattern does not use a three-dimensional structure but rather modifies the perimeter shape of the front planar panel with additional ballistic material to provide enhanced coverage at the sides of the chest. (This is described as a flat female design.)

The focus group participants noted that in their experience, these designs do not conform well to their body contours.

### 3.2 COVERT CARRIERS AND EXTERIOR CARRIERS

One of the most important clarifications provided by the discussions was the distinction between a covert-style body armor carrier versus an exterior vest, as illustrated in Figure 3-2 and Figure 3-3. The covert body armor carrier is designed to be worn under clothing and is considered the basic body armor model that is ordered for law enforcement personnel. The covert carrier can be concealed under a uniform or civilian clothing or, in some situations, some users may choose to wear it over their clothing (and in some cases under a sport jacket or winter jacket).



*An empty covert carrier (white) is shown to the right of the ballistic panel (gray) it is designed to carry. The flaps at the bottom of the carrier serve as shirt-tails to tuck into the wearer's pants.*



*Front of the exterior carrier designed to hold the ballistic panel. This carrier is an example of the modular lightweight load-carrying equipment (MOLLE) design.*



*Back of the same exterior carrier.*



*Close-up of the MOLLE loop system.*

**Figure 3-2 Example of Covert Armor and Exterior Vest with MOLLE System**

Distinct from a covert carrier, an exterior vest is designed to be worn over clothing as part of the uniform. The ballistic protection panels from the covert carrier are instead inserted into the exterior vest. Some products can accommodate the covert carrier containing the ballistic panels being inserted into the exterior vest.

In accordance with NIJ certification, the exterior vest is designed to work with specific ballistic panels. The exterior vests may be available with various additional options such as front or back pockets or loops for carrying law enforcement tools. One such exterior vest is known by the acronym MOLLE, which stands for “modular lightweight load-carrying equipment” vest. In some departments, personnel are issued the covert model and may select an exterior vest based on their personal preference for carrying equipment.



*Covert body armor carrier containing ballistic panels that can be worn under a uniform or plain clothes. The darker black panels are areas for Velcro band attachment.*



*Officer inserting the covert armor carrier from the photo at left into her external carrier vest.*



*Exterior carrier vest with pockets. This photo illustrates a Velcro side-closure that fastens from back-to-front.*

**Figure 3-3 Example of Covert Armor and Exterior Carrier with Pockets**

Vendor websites often do not specify distinctive details about the curved design pattern of the interior ballistic panels, and the association between ballistic panel designs and compatible exterior vests may be obscured. The clarifications provided by the focus group on this topic will help to narrow the assessment focus and inform product selection considerations, as described in section 7.0. Additionally, any exterior vest/ballistic panel insert would be vetted by consultation with the NIJ before inclusion in the assessment.

### **3.3 ARMOR CARRIER CLOSURE DESIGNS**

One of the features that is most relevant to body armor fit noted by the focus group participants is also one that may not be well-described in product literature or guidance documents. It concerns the methods used to secure the covert body armor carrier around the wearers' body and is illustrated in Figure 3-4 and Figure 3-5. The front and back panels must connect to each other over the top of shoulders, as well as along the sides of the torso; the sides may connect by fasteners located either under the arms or around the waist. These connections typically involve Velcro bands whose format varies among products. In some cases, the design allows the user to make personal adjustments to determine how the carrier is donned.



*Shoulder straps with back attachment point fixed that are adjustable in the front.*



*Shoulder straps with both ends removable.*



*Wide shoulder strap that stretches in two dimensions.*

**Figure 3-4 Variations in Shoulder Strap Design**



*Separate cummerbund with side ballistic panels.*



*Single strap design for fastening waist.*



*Dual side straps.*

**Figure 3-5 Variations in Side Attachments**

For the shoulder-top connection points, in some models the carrier has sewn-in straps that go over the shoulders, while other designs use separate Velcro shoulder straps that may be cut to size and/or angled for a custom fit. Once fit, both ends of the straps may remain attached so that the armor is donned over the head, or one end may be detached and reconnected at each donning. The length and positioning of the shoulder straps affects the coverage at the top of the chest as well length of the armor and its coverage of the abdomen. Other characteristics of the shoulder strap such as the width and the amount and direction of fabric stretch may be a factor in personal choice for comfort and fit.

At the sides of the torso, the front and back panels of the body armor are joined such that they overlap, and the user may be able to customize that side attachment in various ways. For example, in some designs, the Velcro band may be completely removable so that the user can choose which end to keep attached (after doffing/in storage), while the other end remains open to be fastened each time it is donned. This allows donning such that the user can choose whether to pull the band back-to-front or front-to back to achieve a snug fit.

Various products may have single or double removable Velcro straps for fastening on each side that allow the user to make additional small adjustments (e.g., to position dual straps in parallel or crossed in an “X” style).

In an alternate design, side protection is achieved with additional ballistic panels contained in a cummerbund-style band that wraps around the waist. The cummerbund may also serve to secure the front and back panels.

### **3.4 ARMOR TRANSPORT AND STORAGE**

The focus group noted that their armor must be stored flat as hanging it from a hanger could stretch the shoulder straps. Two of the participants brought their storage and transport bag, which is shown in Figure 3-6.



**Figure 3-6 Bag for Armor Storage and Transport**

### **3.5 ARMOR USE SCENARIOS**

The focus group participants described their various use-cases for body armor. For some, it is not worn all the time but rather when they participate in operations and protective missions, during defensive tactics training or at a shooting range for practice and qualification. Others wear it continuously while on patrol, which may be up to 6 hours for canine patrols, or up to 16 hours in uniform or plain clothes work. These work shifts may involve many different activities, such as sitting in a vehicle, entering and exiting various indoor and outdoor environments while interacting with the public on the streets and returning to the police station, as well as various operational situations that may include running, jumping fences and processing arrests.

Some agency missions require wearing concealable armor, such as special agents in tailored business suits assigned to protect persons, or police officers working in plain-clothes assignments, while other missions call for external uniform vests, such as a uniformed division protecting property, or police officers patrolling an event.

## 4.0 EVALUATION CRITERIA RECOMMENDATIONS

Table 4-1 summarizes the evaluation criteria and their associated weights, as well as the percentages assigned to the SAVER categories. The focus group identified 21 evaluation criteria and concluded that usability was the most important SAVER category, followed by the capability, deployability and maintainability categories, respectively. The focus group discussed the affordability category but did not identify any criteria for that category.

Table 4-1 Evaluation Criteria

SAVER CATEGORIES				
Usability	Capability	Deployability	Maintainability	Affordability
Overall Weight 50%	Overall Weight 30%	Overall Weight 15%	Overall Weight 5%	Overall Weight 0%
Evaluation Criteria				
<b>Belt and Vest Compatibility</b> Weight: 5	<b>Non-Prohibitive Movement</b> Weight: 5	<b>Closure Direction</b> Weight: 5	<b>Carrier Laundering</b> Weight: 3	
<b>Comfort</b> Weight: 5	<b>Storage Options</b> Weight: 4	<b>Top Attachment Points</b> Weight: 3	<b>Carrier Durability</b> Weight: 2	
<b>Cup Size</b> Weight: 5	<b>Ability to Conceal</b> Weight: 3	<b>Side Attachment Points</b> Weight: 3	<b>Storage Bag</b> Weight: 1	
<b>Female Design</b> Weight: 5	<b>Exterior Vest Accessory Options</b> Weight: 3	<b>Cummerbund Design</b> Weight: 3		
<b>Fit Measurement Process</b> Weight: 5	<b>Color</b> Weight: 1	<b>Ease of Donning/Doffing</b> Weight: 1		
<b>Carrier Material</b> Weight: 4		<b>Panel Insertion/Removal</b> Weight: 1		
<b>Length</b> Weight: 4				

## 4.1 USABILITY

Seven usability criteria were identified and defined by the focus group.

**Belt and Vest Compatibility** refers to the ability for law enforcement officers to readily access their weapons and tools at their waist, from a holster or holder on their belt, without being impeded by the armor.

**Comfort** refers to the overall feel of the armor while doing everyday activities, such as standing, sitting, walking or driving a car, especially in warm weather.

**Cup Size** refers to an element of sizing necessary to properly fit the female form in addition to the chest circumference. Cup size accounts for breast volume and is conventionally designated by one or more capital letters such as A, B, C and D. The focus group would like to have body armor cup sizing available in a range of sizes to include size A, B, C, D and higher sized cups.

**Female Design<sup>iv</sup>** refers to the fit of the front panel shape that is curved to match the female shape. Current designs include the structured three-piece, two-piece and dart styles or female flat style (curved perimeter). The focus group noted that they would like the assessment to include various designs (from various manufacturers) for evaluations and comparison of how they fit the female physique.

**Fit Measurement Process** refers to the process for determining the appropriate size armor for an individual. For example, in some cases the user may be asked to provide her own measurements, in others, she may be measured by a vendor representative or someone at her agency. In situations where the user will be measured, focus group members said they would be most comfortable with measurements by a female representative.

**Carrier Material** refers to the material the carrier is made of—typically canvas or nylon—containing the ballistic plates and holding them against the body. The participants noted that material that allows for air circulation and/or moisture wicking, can help with cooling and comfort. Note: ballistic panels are enclosed in a non-removable waterproof casing that is distinct from the carrier material.

**Length** refers to the vertical dimension of the armor when worn. The focus group noted that it should be long enough to cover the abdomen but not so long that it overhangs the belt.

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<sup>iv</sup> This criterion was labelled Cut (Perimeter Shape) during the focus group discussion as a place-holder for a more appropriate term. Since “perimeter” has a broader meaning in the NIJ standard, applying to male armor as well, the term “female design” is used here as an apt replacement.

## 4.2 CAPABILITY

Five capability criteria were identified and defined by the focus group.

**Non-Prohibitive Movement** refers to the unconstrained ability to use arms and upper body to perform job tasks unimpeded. This includes driving a car, accessing a holster and running or climbing. Focus group participants noted that sitting in a car with armor feels like being in a box and it may get in the way of their arms.

**Storage Options** refers to exterior pockets and loops on the external carrier vest for carrying equipment. Some officers prefer to carry equipment in the vest to reduce the utility belt weight burden on their hips, and to avoid overlap.

**Ability to Conceal** refers to the ability to wear the vest under civilian style clothing such that it is not visible.

**Exterior Vest Accessory Options** refers to non-covert carrier variations that are compatible<sup>v</sup> with a given ballistic armor panel design such that the panels are properly positioned against the body when worn in the exterior vest in place of the covert carrier. The exterior vests may offer additional equipment carrying options, i.e., pockets or loops, to carry law enforcement accessories, such as flashlights, handcuffs and weapons. This refers to how accessories fit on or in the vest depending on the type of storage options.

**Color** refers to options available for the armor carrier, some agencies require white for concealability under a suit.

## 4.3 DEPLOYABILITY

Six deployability criteria were identified and defined by the focus group.

**Closure Direction** refers to the method by which the front and back panels of the body armor are joined at the sides of the body, below the arms. Typically, a Velcro band is used to fasten them—the focus group noted that it is easier to don if the back overlaps the front, i.e., back-to-front—because reverse designs (front-to-back) require a partner to help with donning to get a properly snug fit.

**Top Attachment Points** refers to shoulder strap designs that vary among products but typically attach with Velcro fasteners. In some designs, the carrier has built-in straps that go over the shoulders, while other designs use separate straps of different materials that may be adjusted and/or cut to size.

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<sup>v</sup> Note that the carrier must be designated as compatible for a specific make and model of ballistic panel to ensure that it is held in proximity to the body consistent with the NIJ certification testing; mixing brands may reduce protection and is not recommended by the NIJ.

**Side Attachment Points** refers to the fasteners used to enclose the front and back panels along the sides of the body. These vary among products and may include a zipper or single or double removable Velcro straps on each side that allow the user to make small adjustments, such as to position dual straps in parallel or crossed in an “X” style, and to select back-to-front or front-to-back donning. Some products that have a cummerbund may not include additional side attachment points.

**Cummerbund Design** refers to a separate panel that wraps around the waist to provide ballistic protection on the sides of the body and may also serve to join the front and back ballistic panels. Not all products may have this; some may use both a separate cummerbund plus side fasteners.

**Ease of Donning/Doffing** refers to putting on the armor and securing it to fit (donning) and removing it after use (doffing). The focus group noted that the donning speed is not a significant consideration but being able to independently don armor to efficiently achieve a good fit each time, is important.

**Panel Insertion/Removal** refers to positioning the ballistic panels in relation to the carrier, including taking them out before washing the carrier, and replacing them afterwards in the proper orientation within the carrier.

#### 4.4 MAINTAINABILITY

Three maintainability criteria were identified and defined by the focus group.

**Carrier Laundering** refers to how the carrier is cleaned after wearing, e.g., machine washed or dry cleaned.

**Carrier Durability** refers to the ruggedness of the component materials and the design and construction characteristics of the covert shell or external vest.

**Storage Bag** refers to a designated container that enables the ballistic panels to be laid flat for transport and storage. The focus group noted that armor must be stored flat and not hung from a hanger because hanging could stretch the shoulder straps and impact fit.

#### 4.5 AFFORDABILITY

No criteria were selected for the affordability category. The main comment the focus group expressed regarding this category was that they were willing to pay whatever is necessary to obtain body armor that is comfortable and does not reduce their protection<sup>vi</sup>. (Some departments issue body armor, and others provide an allowance for users to purchase their own.) They did not identify any affordability restrictions.

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<sup>vi</sup> In practice, personnel sometimes purchase covert armor and exterior vests on their own if they are not satisfied with the fit and comfort of their standard-issue body armor products.

## 5.0 EVALUATION CRITERIA ASSESSMENT RECOMMENDATIONS

The focus group made recommendations on whether the evaluation criteria should be assessed operationally or by review of the manufacturer’s specifications. In an operational assessment, evaluators assess criteria based on their hands-on experience using the products. In a specification assessment, evaluators score the criteria based on product information provided by the vendors or by inspection. In some cases, criteria may be assessed both operationally and by specification.

Table 5-1 presents the focus group’s assessment recommendations for evaluation criteria.

Table 5-1 Evaluation Criteria Assessment Recommendations

Category	Criteria	Operational	Specification
Usability	Belt and Vest Compatibility	✓	
	Comfort	✓	
	Cup Size	✓	
	Female Design	✓	
	Fit Measurement Process	✓	✓
	Carrier Material	✓	✓
	Length	✓	
Capability	Storage Options	✓	✓
	Ability to Conceal	✓	✓
	Exterior Vest Accessory Options	✓	✓
	Non-Prohibitive Movement	✓	
	Color		✓
Deployability	Closure Direction	✓	
	Cummerbund Design	✓	
	Side Attachment Points	✓	
	Top Attachment Points	✓	
	Ease of Donning/Doffing	✓	
	Panel Insertion/Removal	✓	
Maintainability	Carrier Laundering		✓
	Carrier Durability	✓	✓
	Storage Bag	✓	✓

## 6.0 ASSESSMENT SCENARIO RECOMMENDATIONS

Based on the applications and use-cases discussed, the focus group recommended six scenarios in which products could be assessed using the evaluation criteria recommended for an operational assessment in Table 4-1. To include the effects of sweating and cooling, the focus group recommended that the assessment be conducted in warm weather conditions, because they have found that armor is more uncomfortable in the summer months rather than in the winter months. All assessments will be conducted with scenarios that include evaluators wearing each model of armor being assessed.

### 6.1 PROCUREMENT/FITTING (PRE-ASSESSMENT)

The products being assessed will need to be procured and fitted to each evaluator. The procurement fitting process should be initiated at least six weeks in advance to allow time for measurements, ordering, delivery and adjustments, if needed. Prior to, or at the time of the assessment, the evaluators will be asked about their experiences associated with the fitting process for each product. Evaluation criteria scored during this scenario will include: measuring process, cup sizing, female design, ability for user to optimize fit via attachment points and storage bag availability and quality.

### 6.2 DONNING AND DOFFING

Before participating in the scenario activities, the evaluators will remove their armor from the storage bag, if applicable, and don body armor over the same type of garment they would normally wear under covert armor on duty, adjusting the attachments as possible to achieve the best fit. (Their exterior garments may vary according to the scenario and are likely to be agency-specific for each evaluator.) After completing the scenarios described in sections 6.3 to 6.6, the evaluators will doff the armor and then remove the ballistic plates as if they were going to launder the covert carrier. They will then reassemble the armor and store it in the carrying bag, if available. Evaluation criteria scored during this scenario will include: ballistic panel removal and insertion, ease of donning and doffing; attachment points (chest, body), cummerbund design, direction of side Velcro closures and carrier durability.

### 6.3 SURVEILLANCE

Evaluators conducting surveillance while wearing body armor under civilian clothes will stand and sit for long periods of time. This would be challenging to achieve during a typical 2-day assessment. NUSTL will explore the feasibility of having evaluators wear the vests for an extended time outside of the assessment. Evaluation criteria scored during this scenario will include: comfort, non-prohibitive movement, length, carrier material, carrier durability and concealability.

## 6.4 PATROL CAR

Evaluators will get in and out of a law enforcement vehicle, put seat belts on and off, back up and drive the vehicle, reach for equipment and operate a radio. They will exit the vehicle in a routine manner and remove items of their choice from their utility belt, such as a flashlight to inspect the back seat of a stopped vehicle. The details are to be determined depending on the venue and evaluator input. They will also exit the vehicle in an expedited fashion, chase a suspect in a short sprint, tackle and cuff the suspect, return to their vehicle with the suspect, guide them into the vehicle and return to the station where they will guide the suspect out of the vehicle and enter the station to process the arrest. A law enforcement training specialist will be consulted to safely simulate this scenario at the assessment<sup>vii</sup>. Evaluation criteria scored during this scenario will include: non-prohibitive movement, compatibility of vest with utility belt, carrier material, length, comfort in varying environments (inside vehicle, outdoors, inside building) and carrier durability.

## 6.5 PHYSICAL TRAINING/DEFENSIVE TACTICS

These activities will be derived from typical law enforcement training scenarios, such as those conducted by DHS Homeland Security Investigations (HSI) in quarterly training exercises that simulate situations encountered by law enforcement officers. Evaluators will run long and short distances, maneuver around obstacles and scale fences, climb stairs, jump over objects, crawl, clear rooms in a house or warehouse and/or conduct other realistic activities as suggested by trainers that involve motions relevant to assessing body armor. Evaluation criteria scored during this scenario will include: non-prohibitive movement (over a range of motion), compatibility of vest with utility belt, length, comfort, carrier material and the evaluator's impression of carrier durability.

## 6.6 WEAPONRY

Evaluators wearing body armor will get experience drawing various weapons, as well as, transitioning between weapons. In a simulated scenario they will draw their baton, transition to drawing a taser, followed by a mock handgun. For handgun usage, they will draw on a target and assume a shooting stance, access ammunition to simulate re-load, and then transition to drawing a long gun and shouldering the weapon. Mock weaponry will be used as appropriate; no actual weapons will be used during the assessment. NUSTL will rely on law enforcement training professionals at the venue site to develop safe simulations of weapon and firearm usage, such as using mock weapons or, if feasible, a professional training shooting range. Evaluation criteria scored during this scenario will include: non-prohibitive movement, storage options, vest and belt compatibility, length, comfort, carrier material and carrier durability.

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<sup>vii</sup> For example, training mannequins may be used for the object of the tackle and arrest, and perhaps evaluator pairs may race toward pre-positioned mannequins to simulate chasing a suspect.

## 7.0 ASSESSMENT SCOPE AND PRODUCT SELECTION RECOMMENDATIONS

The group advised focusing the scope of the assessment on products having NIJ certification to protection level IIIA. Level IIIA will be designated NIJ HG2.07 in the new NIJ performance standard's naming convention. The motivation for this is that law enforcement agencies would only purchase NIJ-certified products, and many agencies require protection at level IIIA to be consistent with department-issued weapons. The focus group reasoned that only products certified to the same level of protection should be compared with each other at the assessment. Some departments allow level IIA armor; such products would be of interest to those departments but would have to be assessed separately from those rated at level IIIA.

The focus group also recommended that the assessment focus primarily on covert armor products—that is products in which the ballistic armor is contained in a carrier designed to be worn under clothing (either an agency-issued uniform or on-duty civilian style clothing). This approach will isolate the characteristics most important for fitting armor to the female physique and avoid confounding the assessment by secondary features associated with external vests<sup>viii</sup>. They reasoned that if the covert model fits well, then those same ballistic panels are also likely to fit well when used in exterior carriers.

They further suggested that if the covert armor models selected for the assessment offer compatible exterior carrier vests then the exterior vest should also be assessed, as a secondary aspect to the assessment<sup>ix</sup>. They noted that some personnel routinely wear exterior vests and that the equipment carrying options may be preferable to their utility belt for some users. NUSTL will need to explore if a 2- or 3-day assessment would provide sufficient time to conduct a thorough assessment of both covert armor and compatible exterior armor carriers. During the assessment, criteria that do not pertain to this type of armor will not be rated (otherwise low scores for those criteria will be confusing).

The focus group identified additional criteria for product selection that would include features they deem essential, while also providing an opportunity to compare products with variations in design. The focus group estimated that a comparative assessment of at least four products is a practical number that should provide a representative sample of the market. Table 7-1 presents the product selection criteria. Final selection will be based on the availability of NIJ certified products and how well those products meet the selection criteria. The NIJ CTP PM, focus participants and assessment evaluators will be consulted during product selection.

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<sup>viii</sup> External carrier options primarily relate to capacity to carry law enforcement tools, which is distinct from issues related to the fit of the ballistic panels to the female body and may be more strongly associated with user preferences or agency policy.

<sup>ix</sup> If numerous exterior carriers are offered, focus group participants and/or assessment evaluators would be consulted to provide professional judgment and practical experience representing a range of mission applications to finalize the product selections for procuring appropriate products for the assessment.

**Table 7-1 Product Selection Criteria**

Product Selection Criteria	Description
NIJ Standard-0101.07 Compliance <sup>x</sup> with Ballistic Protection Level IIIA (NIJ HG2.07)	Ballistic-resistant body armor must be NIJ certified for level IIIA. Note: ballistic protection level II could also be tested if feasible, but should be separate from level IIIA
Covert Armor	Ballistic panel carrier is designed to be worn under clothing.
Various Female Styles	Include products with various distinct geometric shapes intended to accommodate the female physique, such as the 2-piece, 3-piece, dart and extended perimeter. If possible, include a design with separate individual cups.
Side Panel Straps Allow Back-to-Front Attachment for Donning	Armor models may have the back end of the strap fixed in place or have removable straps that allow the user to position one end to achieve back-to-front donning.
Sizing Features	The cup size should ideally be specified in addition to chest size. A range of cup sizes beyond size “C” is preferable. Measurements should include torso length, and the product should be available in different lengths. Measurement by a professionally trained fitter of the same gender is preferred.
Variations in Attachment Points at Top and Sides	A representative sample of design variations is recommended for comparison. In some designs the carrier has built-in straps that go over the shoulders, while other designs use separate Velcro shoulder straps that may be adjusted and cut to size. Waist/side closure designs may have one or more removable Velcro straps that allow the user to make small adjustments for example to position dual straps in parallel or crossed in an “X” style. Some may use a cummerbund.
Different Materials for Interior Lining	Breathable and moisture wicking fabrics are of interest for regulating body temperature in warm weather and for comparison with other fabrics for flexibility and movement.
Exterior Carrier Vest Options with Various Accessories	If the covert armor selected for the primary assessment also offers exterior carrier options, those should be included as a secondary part of the assessment. A variety of features including pockets for trauma packs <sup>xi</sup> , MOLLE, equipment loops and closure configurations.

<sup>x</sup> The NIJ's *Ballistic Resistance of Body Armor* performance test standard has been revised to address higher threat levels and with additional specifications for armor designed for women; it is expected to be released in 2020.

<sup>xi</sup> Four of the six focus group participants currently use trauma packs

The focus group could not recommend specific products to assess because product eligibility will be contingent on passing the new NIJ performance standard. The NIJ CPT PM noted that there are more body armor vendors than manufacturers, so it is important to ensure that distinct product designs are selected. (For example, the NIJ CPT PM estimated there are currently about 50 to 60 manufacturers making body armor for women and about 200 vendors selling them.)

The focus group participants reported that they are currently using products from the following companies:

- Point Blank (manufacturer)
- Strike Face (vendor)
- Velocity (vendor)
- Armor Express (manufacturer)

So that the assessment can be informative to a wide range of female personnel who wear body armor, the focus group noted that it would be useful to include evaluators with different body types and that the type of clothing evaluators chose to wear under or over the armor during the assessment should be noted in the assessment report.

## 8.0 FUTURE ACTIONS

The focus group recommendations will be used to develop an assessment plan for women's ballistic-resistant body armor and will guide the selection of products for evaluation during the assessment. The assessment is pending release of the updated ballistic resistant body armor performance test standard. Once the assessment is complete, the results will be available on [www.dhs.gov/publication/ballistic-resistant-body-armor-women](http://www.dhs.gov/publication/ballistic-resistant-body-armor-women).

## 9.0 CONCLUSION

The focus group, which consisted of six law enforcement subject matter experts with 3 to 30 years of experience, identified 21 evaluation criteria for ballistic-resistant body armor that will be used when scoring products during the assessment. The highest weighted SAVER categories were usability (weight of 50 percent) and capability (weight of 30 percent). Seven criteria were assigned the highest weighting of 5:

- Belt and vest compatibility
- Comfort
- Cup size
- Fit measurement process
- Female design
- Non-prohibitive movement
- Closure direction

After identifying, defining and prioritizing the evaluation criteria, the focus group provided recommended test scenarios and activities to be performed during the assessment. The information gathered during the focus group will be used to develop the test plan for the SAVER assessment of Ballistic-Resistant Body Armor for Women to be led by NUSTL.

## 10.0 ACKNOWLEDGEMENTS

NUSTL thanks the focus group participants for their valuable time and expertise. Their insights and recommendations will guide the planning and execution of the assessment as well as future SAVER projects. Appreciation is also extended to the home jurisdictions of the participants for allowing them to participate in the focus group.

## 11.0 REFERENCES

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