System Assessment and Validation for Emergency Responders (SAVER)

Body-Worn Video Cameras for Law Enforcement Assessment Report

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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 supported by a network of Technical Agents who perform assessment and validation activities. As a SAVER Program Technical Agent, the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic has been tasked to provide expertise and analysis on key subject areas, including communications, sensors, security, weapon detection, and surveillance, among others. In support of this tasking, SPAWARSYSCEN Atlantic developed this report to provide emergency responders with information obtained from an operationally oriented assessment of body-worn video cameras for law enforcement, which fall under AEL reference number 13LE-00-SURV titled Equipment, Law Enforcement Surveillance.

For more information on the SAVER Program or to view additional reports on body-worn video cameras for law enforcement or other technologies, visit www.firstresponder.gov/SAVER.

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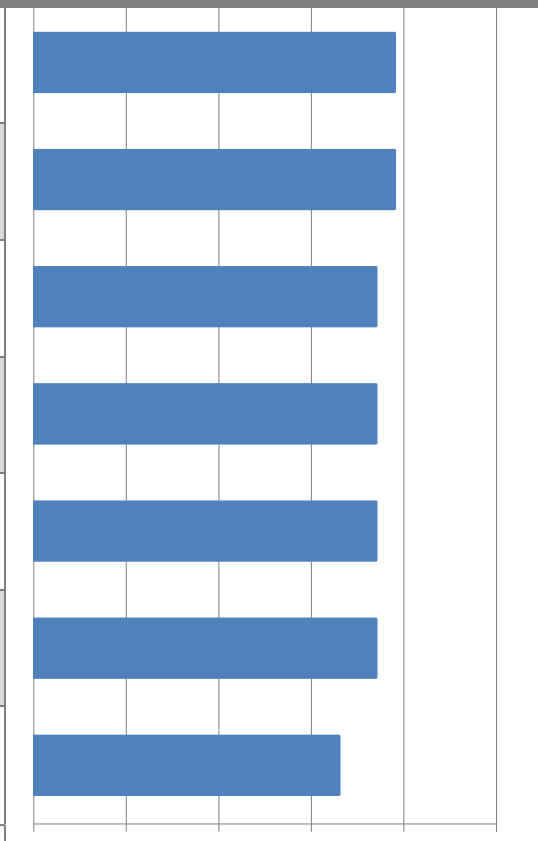
EXECUTIVE SUMMARY

Body-worn video cameras are valuable tools that can be used by law enforcement to record traffic stops, arrests, sobriety tests, and interviews. Body-worn video camera systems typically consist of a camera, microphone, battery, and onboard storage. They are designed to be head-mounted or worn at various locations on the body, depending on the model. In January 2015, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of body-worn video cameras for law enforcement.

Seven body-worn video cameras were assessed by emergency responders. The criteria and scenarios used in this assessment were derived from the results of a focus group of emergency responders with experience using body-worn video cameras. The assessment addressed 16 evaluation criteria in three SAVER categories: Capability, Deployability, and Usability. The overall results of the assessment are highlighted in the following table.

Product	Overall Score	Overall	Capability	Usability	Deployability
Safety Vision LLC Prima Facie Body Camera		**3.9**	4.1	3.7	3.8
TASER International Inc. AXON Flex		**3.9**	3.9	3.8	3.9
Pinnacle Response Ltd. PR5		**3.7**	3.8	3.6	3.6
Black Mamba Protection LLC BMPpro+		**3.7**	3.9	3.3	3.7
VIEVU LLC LE3		**3.7**	3.5	3.8	4.0
Digital Ally Inc. FirstVu HD		**3.7**	3.6	3.5	4.1
Wolfcom Enterprises Wolfcom 3rd Eye Police Body Camera		**3.3**	3.8	2.8	2.6

1. INTRODUCTION

Body-worn video cameras are valuable tools that can be used by law enforcement to record traffic stops, arrests, sobriety tests, and interviews. Body-worn video camera systems typically consist of a camera, microphone, battery, and onboard storage. They are designed to be head-mounted or worn at various locations on the body, depending on the model. In January 2015, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of body-worn video cameras for law enforcement. The purpose of this assessment was to obtain information on body-worn video cameras that will be useful in making operational and procurement decisions. The activities associated with this assessment were based on recommendations from a focus group of emergency responders with experience using body-worn video cameras.

1.1 Evaluator Information

Five emergency responders from various jurisdictions and with experience using body-worn video cameras were selected to be evaluators for the assessment. Evaluator information is listed in Table 1-1. Prior to the assessment, evaluators signed a nondisclosure agreement, conflict of interest statement, and photo release form.

Table 1-1. Evaluator Information

Evaluator	Years	State
Captain, Field Services Bureau	20+	GA
Corporal, Patrol Division	20+	NC
Sergeant, Patrol Division	11-15	SC
Patrol Officer, Patrol Division	11-15	WA
Senior Patrol Officer, Patrol Division	0-5	ID

1.2 Assessment Products

Seven products were selected and purchased for the assessment based on market research and the focus group's recommendations. Final selection was based on how well each product met the product selection criteria identified by the focus group and listed below.

- The camera should be able to record continuously for at least 3.5 hours on a fully charged battery
- The camera's onboard storage, at the highest video quality settings, should permit at least 5 hours of recording
- Camera purchase should include, at a minimum, a 1-year warranty.

Purchase of the VIEVU LLC LE3 includes a 90-day warranty; however, it was selected for assessment since optional warranties of 1 and 2 years were available. The remaining products selected for assessment met all product selection criteria.

Table 1-2 presents the products that were assessed.

Table 1-2. Assessed Products

Vendor	Product	Product Image
Black Mamba Protection LLC	BMPpro+	
Digital Ally Inc.	FirstVu HD	
Pinnacle Response Ltd.	PR5	
Safety Vision LLC	Prima Facie Body Camera	
TASER International Inc.	AXON Flex	
VIEVU LLC	LE3	
Wolfcom Enterprises	Wolfcom 3rd Eye Police Body Camera	

2. EVALUATION CRITERIA

The SAVER Program assesses products based on criteria in five established categories:

- **Affordability** groups criteria related to life-cycle costs of a piece of equipment or system
- **Capability** groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more relevant tasks
- **Deployability** groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use
- **Maintainability** groups criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders
- **Usability** groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

The focus group of emergency responders met in December 2010 and identified 25 evaluation criteria within five SAVER categories: Affordability, Capability, Deployability, Maintainability, and Usability. They assigned a weight for each criterion's level of importance on a scale of 1 to 5, with 1 being somewhat important and 5 being of utmost importance. The SAVER categories were assigned a percentage to represent each category's importance relative to the other categories.

Products were assessed against 16 evaluation criteria. Nine criteria recommended by the focus group were not assessed. Power, Data Storage, Data Security, Software Requirements, Operating/Storage Temperatures, and Recharge Method/Time were not assessed because these specifications are better assessed by jurisdictions during the procurement process as they are often specific to the requirements of the jurisdiction. Battery Access was not assessed because the majority of the products did not have a removable battery. Streaming Video was not assessed since only two of the products featured wireless streaming. Value was not assessed because jurisdictions have varying budgets available for purchasing equipment and product performance should be assessed separately from cost. Because none of the criteria in the Maintainability and Affordability categories were assessed, these categories were not included in the assessment. To account for two less categories and less criteria in the other three categories, the Capability, Usability, and Deployability category weights were changed from their original weights to the SAVER Program standard weights of 50, 33, and 17 percent, respectively. Also, evaluator comments regarding the ease of placing the cameras in covert mode (when applicable) were collected even though this was not directly associated with any of the assessed criteria.

Table 2-1 presents the evaluation criteria and their associated weights as well as the percentages assigned to the SAVER categories. Refer to Appendix A for evaluation criteria definitions and Appendix B for evaluation criteria considerations.

Table 2-1. Evaluation Criteria

SAVER CATEGORIES				
Capability	**Usability**	**Deployability**	**Maintainability**	**Affordability**
Overall Weight 50%	Overall Weight 33%	Overall Weight 17%	Overall Weight 0%	Overall Weight 0%
Evaluation Criteria				
Image Quality Weight: 5	**Physical Characteristics** Weight: 4	**Attachment Options** Weight: 4	**Recharge Method/Time** Not Assessed	**Value** Not Assessed
Low-Light Capability Weight: 5	**Camera Activation** Weight: 4	**Durability** Weight: 3	**Battery Access** Not Assessed	
Power Not Assessed	**Instant Video Playback** Weight: 4	**Operating/Storage Temperatures** Not Assessed		
Data Storage Not Assessed	**Point of View** Weight: 4	**Interference** Weight: 3		
Field of View Weight: 4	**Software Requirements** Not Assessed			
System Indicators Weight: 3				
Audio Quality Weight: 3				
Data Security Not Assessed				
Video Tagging Weight: 3				
Microphone Options Weight: 3				
Data Transfer Weight: 3				
Streaming Video Not Assessed				
Illumination Control Weight: 1				

3. ASSESSMENT METHODOLOGY

The products were assessed over four days. On the first day of the assessment, a subject matter expert (SME) and facilitators presented a safety briefing and an overview of the assessment process, procedures, and schedule to the evaluators. Each product was then assessed in an operational assessment.

During the operational assessment, evaluators assessed each product based on their hands-on experience using the product after becoming familiar with its proper use, capabilities, and features. The SME and facilitators assisted the evaluators throughout the assessment, and evaluators had access to the reference material included with each product. The products were assessed in four scenarios: (1) product familiarization, (2) nighttime traffic stop, (3) daytime traffic stop, and (4) residential call. Evaluators used the products one at a time during the scenarios and provided ratings and comments for each product before assessing the next product. Throughout the assessment the evaluators wore their duty uniform and protective vests. Evaluators also used their duty flashlights, gloves, and jackets as needed during the assessment. All video was captured using the highest resolution settings.

3.1 Product Familiarization Scenario

During the product familiarization scenario, evaluators reviewed the attachment options included with purchase and, if there were multiple wearable components, inspected the system to determine if cables and connections were breakaway. Evaluators then reviewed the user manual to become familiar with the body-worn video camera and to determine how to accomplish any of the following that applied:

- Power on the camera (standby mode)
- Start/Stop recording
- Enter covert mode
- Start/Stop capturing audio
- Manually control the illuminator
- Play back video on the camera's display
- Transfer video to the laptop
- Tag video and/or add additional information (e.g., case number).

If equipped, evaluators manipulated the manual IR illuminator and inspected the camera's microphone options. Next, evaluators attached the camera and associated body-worn components (if applicable) to further assess Attachment Options. Evaluators also observed the system indicators while the camera was in standby (if applicable) as well as when it was recording to determine if the indicators met expectations. Cameras with covert mode were then placed in covert mode before evaluators inspected the indicators for covertness. Evaluators powered off the camera and provided ratings and comments for Camera Activation, Physical Characteristics, and Durability. In addition, evaluators put the cameras in covert mode if available and provided comments on how easily the camera could be switched between covert and normal modes.

3.2 Nighttime Traffic Stop Scenario

For the nighttime traffic stop scenario, cameras were switched to covert mode so evaluators would be able to assess the covertness of system indicators. During this scenario, two vehicles were parallel parked with approximately 15 to 20 feet between the vehicles. Two assessment facilitators were located in the first (front) vehicle and referred to as the driver and passenger. The evaluators took turns with each body-worn video camera and were positioned next to the second (rear) vehicle, which was a patrol car. The blue lights and spotlight were both activated at the start of the scenario.

Figure 3-1. Nighttime Traffic Stop Scenario

First, the evaluator powered on the camera, initiated recording, and approached the driver side window of the vehicle in front to begin interviewing the driver and passenger by asking standard traffic stop questions (Figure 3-1). Next, the evaluator asked the driver to step out of the vehicle and complete a standard field sobriety test, including a horizontal gaze nystagmus (HGN) test and a walk-and-turn test. At this time the blue lights on the patrol car were turned off. Then, the evaluator asked the driver for permission to search the vehicle and asked the passenger to exit the vehicle. At this time the spotlight on the patrol car was turned off. The evaluator used a flashlight as necessary to search the front seat, back seat, and trunk of the vehicle. Upon completion of the search, the evaluator asked the driver and passenger several questions regarding items found during the search and then stopped recording video and turned the camera off. This scenario was repeated for each camera before evaluators reviewed the videos as a group to assess Low-Light Capability.

3.3 Daytime Traffic Stop and Residential Call Scenarios

During the daytime traffic stop and residential call scenarios, evaluators worked individually and rotated between cameras, completing both scenarios with one camera before providing ratings and comments. Evaluators wore gloves and repeated these scenarios with the next camera in the rotation until all evaluators assessed all cameras.

3.3.1 Daytime Traffic Stop Scenario

For the daytime traffic stop scenario, two vehicles were parallel parked with approximately 15 to 20 feet between the vehicles. Orange cones were placed across the scene so each camera's field of view could be assessed when the video was reviewed (Figure 3-2). Two assessment facilitators were located in the first (front) vehicle and referred to as the driver and

Figure 3-2. Daytime Traffic Stop Scenario

passenger. The evaluators took turns with each body-worn video camera and were positioned next to the second (rear) vehicle, which was a patrol car.

First, the evaluator got into the patrol car and buckled the seatbelt. Next, they powered on the camera and initiated recording before unbuckling the seatbelt and exiting the patrol car. The evaluator then approached the driver side window of the vehicle in front to begin interviewing the driver and passenger by asking standard traffic stop questions. Next, the evaluator asked the driver to step out of the vehicle and complete a standard field sobriety test, including an HGN test and a walk-and-turn test. Then, the evaluator asked the driver for permission to search the vehicle and asked the passenger to exit the vehicle. The evaluator used a flashlight as necessary to search the front seat, back seat, and trunk of the vehicle (Figure 3-3). Upon completion of the search, the evaluator asked the driver and passenger several questions regarding items found during the search and then proceeded to the residential call scenario with the camera still recording.

Figure 3-3. Vehicle Search

3.3.2 Residential Call Scenario

For the residential call scenario, the evaluator approached the designated building until they were approximately 15 to 20 yards away, at which time they began to run until they reached the building entrance. Two facilitators acted as suspects in a domestic dispute and were positioned inside the building. One was located just to the right of the building entrance and the other was located in a back room to the left of the entrance.

The evaluator entered the building with a replica weapon drawn and the suspects called out to disclose their location to the evaluator. The suspect on the right was in a well-lit area and had a replica weapon. The evaluator interviewed and disarmed the suspect at the building entrance (Figure 3-4) before approaching the darkened hallway on the left to search for the other suspect. The evaluator searched the hallway and three rooms off the hallway. The evaluator opened the first door, paused briefly, and then turned on the light. Then, the evaluator turned the light off, closed the door, and continued their search. Next, the evaluator opened the second door and scanned the room using their flashlight before closing the door. Lastly, the evaluator opened the third door, where the suspect with a replica weapon placed on the desk was located (Figure 3-5). The evaluator scanned the room with their flashlight and interviewed the suspect before returning to the building entrance. If the camera was equipped with a manual IR illuminator, the evaluator turned the IR illuminator on and

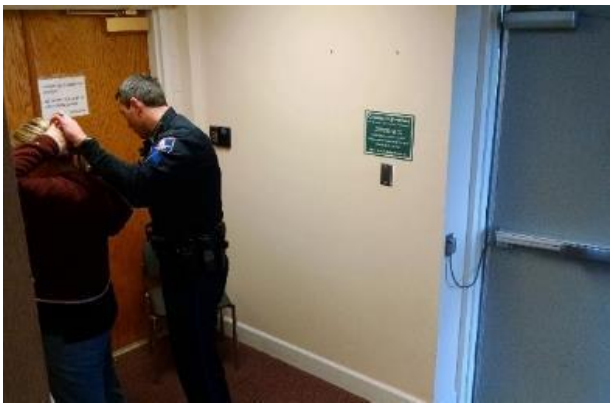


Figure 3-4. Disarming the Suspect at the Building Entrance

revisited the three rooms in the hallway with the same lighting conditions. Then, the evaluator turned the camera off and proceeded to the classroom.

Once in the classroom, the evaluator provided ratings and comments for Camera Activation, Attachment Options, System Indicators, and Interference based on their experience with the camera in the daytime traffic stop and residential call scenarios. Next, if the camera featured a display, the evaluator played back the video on the camera to provide a rating and comments for Instant Video Playback. Then, the evaluator transferred the video from the camera to the laptop using the vendor-provided software for playback on the laptop and reviewed it (Figure 3-6). The evaluator then provided ratings and comments for Data Transfer, Field of View, Point of View, Image Quality, Low-Light Capability, and Audio Quality. To assess Video Tagging, the evaluator checked to see if the video was date/time stamped and if any other information could be added to the video (e.g., case number) that could either help prove authenticity in court or make files easier to manage. Then, the evaluator attempted to export the video files from the vendor-provided software (if applicable) to a standard video format for playback using a standard media player (e.g., Windows Media® Player) to assess Instant Video Playback.

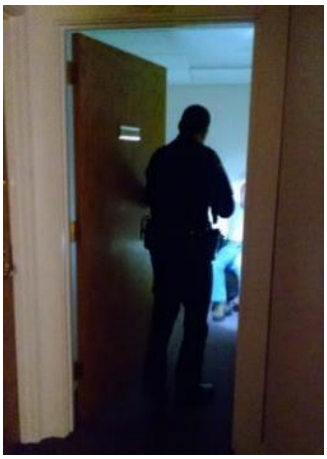


Figure 3-5. Entering Third Room

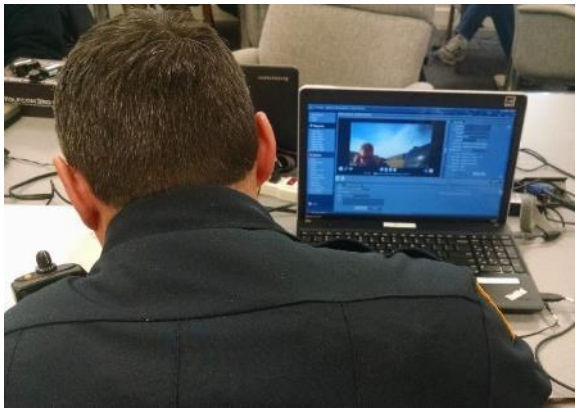


Figure 3-6. Reviewing Video

3.4 Data Gathering and Analysis

Each evaluator was issued an assessment workbook that contained assessment procedures and worksheets for recording criteria ratings and comments. Evaluators used the following 1 to 5 scale to rate each product:

1. The product *meets none* of my expectations for this criterion
2. The product *meets some* of my expectations for this criterion
3. The product *meets most* of my expectations for this criterion
4. The product *meets all* of my expectations for this criterion
5. The product *exceeds* my expectations for this criterion.

Criteria that were rated multiple times throughout the assessment were assigned final overall ratings by the evaluators. Facilitators captured advantages and disadvantages for the assessed products as well as general comments on the body-worn video cameras assessment and the assessment process. Once assessment activities were completed, evaluators had an opportunity to review their criteria ratings and comments for all products and make adjustments as necessary.

At the conclusion of the assessment activities, an overall assessment score, as well as category scores and criteria scores, was calculated for each product using the formulas referenced in Appendix C. In addition, evaluator comments for each product were reviewed and summarized for this assessment report.

4. ASSESSMENT RESULTS

Overall scores for the assessed products ranged from 3.3 to 3.9. Table 4-1 presents the overall assessment score and category scores for each product. Products are listed in order from highest to lowest overall assessment score throughout this section. Calculation of the overall score uses the raw scores for each category, prior to rounding; products with the same rounded overall score are in order based on the raw data.

Table 4-1. Assessment Results

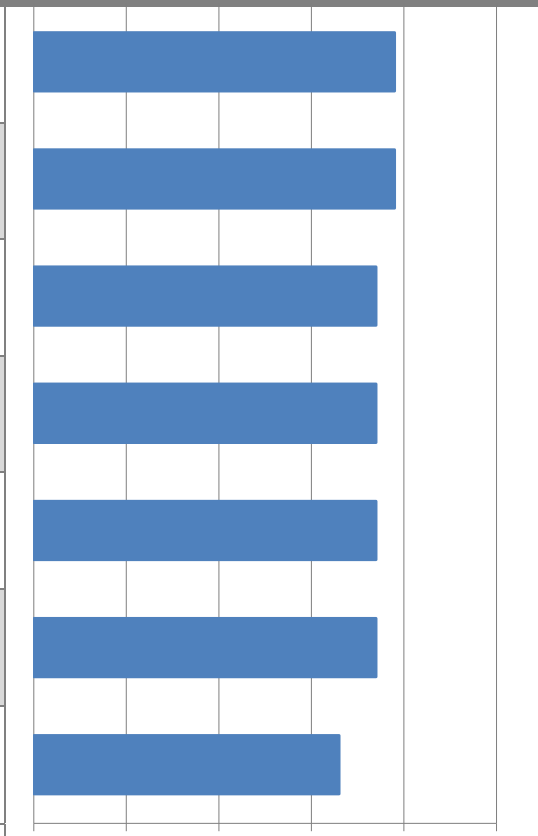
Product	Overall Score	Overall	Capability	Usability	Deployability
Safety Vision LLC Prima Facie Body Camera		**3.9**	4.1	3.7	3.8
TASER International Inc. AXON Flex		**3.9**	3.9	3.8	3.9
Pinnacle Response Ltd. PR5		**3.7**	3.8	3.6	3.6
Black Mamba Protection LLC BMPpro+		**3.7**	3.9	3.3	3.7
VIEVU LLC LE3		**3.7**	3.5	3.8	4.0
Digital Ally Inc. FirstVu HD		**3.7**	3.6	3.5	4.1
Wolfcom Enterprises Wolfcom 3rd Eye Police Body Camera		**3.3**	3.8	2.8	2.6

Table 4-2 presents the criteria ratings for each product. The ratings are graphically represented by colored and shaded circles. A green, fully shaded circle represents the highest rating. Refer to Appendix A for evaluation criteria definitions and Appendix B for evaluation criteria considerations. All seven cameras received a green, three-quarter shaded circle for Audio Quality. Evaluators agreed that audio captured on the video for all the assessed cameras met expectations by capturing relevant conversations. Table 4-3 presents vendor-provided key specifications for the assessed products. All offer options to extend the warranty and have rechargeable batteries. If software is required, it is included with purchase. Optional software, where applicable, is available for an additional cost. All feature internal, mono microphones and date/time stamped video. None of the assessed products have expandable data storage.

Table 4-2. Criteria Ratings

KEY Lowest Rating → Highest Rating							

Category	Evaluation Criteria	Prima Facie Body Camera	AXON Flex	PR5	BMPpro+	LE3	FirstVu HD	Wolfcom 3rd Eye Police Body Camera
Capability	Image Quality	◕	◕	◕	◕	◑	◕	◕
	Low-Light Capability	◕	◕	◕	◕	◑	◕	●
	Field of View	◕	◕	◕	◕	◑	◕	◕
	System Indicators	◕	◕	◕	◕	◕	◕	◑
	Audio Quality	◕	◕	◕	◕	◕	◕	◕
	Video Tagging	◑	●	◑	◕	◕	◕	◕
	Microphone Options	●	◕	◕	◕	◕	◕	◑
	Data Transfer	◕	◕	◕	◕	◕	◑	◕
	Illumination Control	◕	NA	NA	◑	NA	NA	◑
Usability	Physical Characteristics	◕	◕	◑	◑	◕	◕	◔
	Camera Activation	◕	◕	●	◑	●	◕	◔
	Instant Video Playback	◕	◑	◕	◕	◑	◑	◕
	Point of View	◑	◕	◑	◑	◑	◑	◑
Deployability	Attachment Options	◕	◕	◑	◕	◕	◕	◔
	Durability	◕	◕	◕	◕	◕	◕	◑
	Interference	◕	◕	◕	◕	◕	◕	◑

Notes:
NA—Not applicable; camera does not feature an illuminator.

Table 4-3. Key Specifications

Key Specification	Prima Facie Body Camera	AXON Flex	PR5	BMPpro+	LE3	FirstVu HD	Wolfcom 3rd Eye Police Body Camera
MSRP	$579	$848[1]	$895	$650	$899	$795	$475
Proprietary Software Required	Yes; Prima Facie Transfer Agent	Yes; Evidence Sync or EVIDENCE.com	No	Optional	Yes; VERIPATROL	Yes; VuVault	Optional
Software Cost	Included in camera MSRP	Evidence Sync is included with purchase; $285/year with 70 GB online storage[2] on EVIDENCE.com	Not applicable; no proprietary software offered	$575 for a 1 year license[2] and $20/10 GB or $40/25 GB per camera (BMPNest); $375 (BMPNest Lite)	Included in camera MSRP	Included in camera MSRP	$200 (Wolfcom Management Software)
Warranty Duration	1 year	2 years on camera; 90 days on other components	1 year	1 year	90 days	1 year	1 year
Dimensions (inches)	3.7x2.3x1.7	Camera: 3.2x0.8x0.7 Controller: 3.3x2.6x0.8	3.6x2.3x1.2	2.9x1.8x0.9	3.0x2.1x0.85	Camera: 1.5x1.1x1.0 DVR: 4.0x2.6x0.6	3.8x2.4x1.3
Weight (ounces)	5.3	Camera: 0.5 Controller: 3.3	4.2	5.2	2.8	Camera: 0.8 DVR: 3.1	5.5
Camera Lux Rating	0.08	<1.0	0.2	0.01	1.0	0.08	1.0
IR Illuminator	Automatic IR[3]	None	None	Manual IR	None	None	Manual IR
Minimum Video Resolution	720x480	VGA (640x480)	720p (1280x720)	848x480	848x480	VGA (640x480)	848x480
Maximum Video Resolution	1080p (1920x1080)	VGA (640x480)	720p (1280x720)	1080p (1920x1080)	720p (1280x720)	720p (1280x720)	1080p (1920x1080)

Key Specification	Prima Facie Body Camera	AXON Flex	PR5	BMPpro+	LE3	FirstVu HD	Wolfcom 3rd Eye Police Body Camera
Onboard Storage Capacity	32 GB	8 GB	16 GB	32 GB	16 GB	32 GB	32 GB
Hours of Video Stored	6 to 35 hours	4 to 14 hours	5 hours, 10 minutes	8.5 hours at maximum video resolution	12 hours in SD; 6 hours in HD	8 to 100+ hours	8.5 to 17 hours
Pre-Event Record	Yes; 10 seconds	Yes; up to 30 seconds	No	Yes; up to 15 seconds	No	Yes; up to 60 seconds	No
Horizontal Field of View	120°	75°	120°	140°	68°	95°	120°
Display Screen for Playback	2.0-inch color LCD	None[4]	None	2.0-inch color LCD	None	None[5]	2.0-inch color LCD
Video Streaming		✓[6]				✓[7]	
Audio Mute Capability	✓				✓[8]	✓[9]	✓[10]
Record Audio Only	✓			✓			✓
Low-Battery Indicator	Battery meter on display screen turns from green to red when low	Press battery button and battery indicator shows the remaining battery capacity; optional audible indicator	Flashing red LED when camera lens window is open	Battery meter on display screen and flashing red LED	Flashing red LED	Flashing blue LED flashes twice every 5 seconds and vibrates 2 pulses every 5 seconds	Battery meter on display screen
Power On Indicator	Solid green LED	Red on/off indicator (exposed when power switch is in "on" position), beep	Flashing green LED when camera lens window is open	Vibrate and chime at startup with solid green LED	Flashing green LED when camera lens window is open	Blue and orange LEDs on DVR alternate flashing for 10 seconds and DVR vibrates at startup	Chimes and LCD turns on

Key Specification	Prima Facie Body Camera	AXON Flex	PR5	BMPpro+	LE3	FirstVu HD	Wolfcom 3rd Eye Police Body Camera
Video Recording Indicator	Power on indicator turns off and flashing red dot on display	Flashing red LED and 2 beeps every 2 minutes	Flashing green LED when camera lens window is open	Two short vibrations and a beep when initiated, flashing red LED, and flashing red dot on LCD	Flashing green LED when camera lens window is open	Solid red LED on camera and DVR vibrates every 15 seconds	Solid red LED and flashing red dot on the display
Covert Mode	LEDs, display, and IR illuminator are turned off	LEDs and audible indicators are turned off	Not available	LEDs and the display are turned off	Not available	Camera LED is turned off	Display is turned off
Police Radio Interface	✓			✓			✓
GPS	Optional	✓[6]		Optional		✓[7]	✓
Security Features	Device is password-protected, user audit logs automatically updated, video authentication via file properties and digital signature.	Audit trail for EVIDENCE.com includes information such as viewed by, downloaded by, and deleted by, with the source IP address of the person who made the change. Communication to and from EVIDENCE.com is secured using 256-bit AES encryption and FIPS 140-2 compliant ciphers.	None	Audit trail/activity log	FIPS 140-2 digital signature process used to prove authenticity.	May be configured so only designated computers can access recordings.	Camera has admin and user passwords. Password protection in software to access video (software is optional).

Key Specification	Prima Facie Body Camera	AXON Flex	PR5	BMPpro+	LE3	FirstVu HD	Wolfcom 3rd Eye Police Body Camera
User-Replaceable Battery						✓[11]	
Battery Runtime (continuous use)	6 hours	12 hours	5 hours, 10 minutes	10 hours	5 hours in SD; 3 hours in HD	4.5 hours with pre-event enabled	6.5 hours
Recharge Time	4 hours	6 hours	2.5 hours	3 hours	3 hours	4 hours	4 hours
Recharge Method	USB, dock	USB, dock	USB	USB (docking options available)	USB, AC charger (docking options available)	Battery charger, USB (docking options available)	USB
Approximate Battery Life	500 charge cycles	300 charge cycles or 2 years	300 charge cycles or 4 years	1,500 charge cycles	4 years	3 to 5 years	300 charge cycles
Ingress Protection (IP) Rating	IP55	IPX2	IP45	IP67	IPX5	IPX5	IP53
Drop Test Information	9.8 feet to a hard surface	6 feet to concrete	9 feet to concrete	6.5 feet to concrete	10 feet to a hard surface	6 feet to concrete	6 feet to concrete
Operating Temperature	-13° to 140°F	-4° to 122°F	-4° to 120°F	-40° to 140°F	-4° to 122°F	-4° to 158°F	-22° to 131°F
Storage Temperature	-25° to 155°F	-4° to 95°F	-4° to 120°F	-40° to 151°F	68°F	-40° to 176°F	-18° to 127°F

Notes:
✓—product is equipped with corresponding feature.
[1]Includes single-bay docking station for use with uploading to EVIDENCE.com ($249).
[2]Cost varies with terms and storage requirements.
[3]IR illuminator can be disabled for "stealth" mode (i.e., covert mode).
[4]Viewable on mobile devices using Bluetooth via Axon Mobile Android or iOS mobile application (no cost option).
[5]Viewable on in-car camera over Wi-Fi with VuVault Go (additional cost).
[6]Available via mobile devices with Axon Mobile Android or iOS mobile application.
[7]Available via mobile devices with VuVault Go mobile application.
[8]Audio recording is disabled in the software during setup/configuration, not on the camera unit.
[9]There is a no-charge option to order the camera with the audio always on.
[10]Audio recording is disabled in the camera settings during setup/configuration.
[11]Proprietary battery that does not require tools to replace.

4.1 Safety Vision LLC Prima Facie Body Camera

The Prima Facie Body Camera (Figure 4-1) received an overall assessment score of 3.9 and costs $579 as assessed. A camera unit; a rotating clip mount; a shoulder clip mount; a docking station; a USB cable; a power cord; an AC adapter; Prima Facie Transfer Agent software (downloaded); and a hard copy of the user manual were included with purchase. An electronic version of the user manual is also available from the vendor.

Figure 4-1. Prima Facie Body Camera

The following sections, broken out by SAVER category, summarize the assessment results.

Capability

The Prima Facie Body Camera received a Capability score of 4.1. The following information is based on evaluator comments:

- The recorded video was sharp and clear. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. While reviewing the daytime traffic stop scenario video, names on ID cards as well as labels on items in the vehicle (e.g., beer bottles) were readable. In addition, it was evident in the residential call scenario video that the suspect was armed.
- The automatic IR illuminator facilitated easy recognition of people and objects in low-light during the residential call scenario. When placed in covert mode for the nighttime traffic stop scenario, the IR illuminator was disabled and, while people and objects captured on video during this scenario were identifiable, they were sometimes difficult to see.
- The camera captures a wide field of view; all cones appeared on the video captured during the daytime traffic stop scenario, and a wide area of each room was captured on video during the residential call scenario despite the close quarters.
- The visual and audible system indicators met expectations. The LED indicators can be seen by the wearer, and the camera beeps once when recording is started and twice when it is stopped. When in covert mode, none of the LED indicators illuminated, which met expectations; however, the audible indicator still beeped.
- While it is easy to place the camera in covert mode with the press of a button, the button is small and may be difficult to locate in stressful situations, when in low-light conditions, or while wearing gloves.
- The video is stamped with date and time, as well as with a unit ID that can be set with the software. Additional information cannot be added to the files by the user (e.g., case number).
- The camera permits the user to capture audio only without video, which exceeded expectations. In addition, users can easily turn the microphone on and off while

recording because the control is clearly labeled and easily accessible on the top of the camera.

- Data transfer was quick and easy. The transfer software automatically opens when the camera is connected to the computer via a USB cable or docking station, and files are automatically downloaded to a previously designated folder.
- The camera features an automatic IR illuminator, which met expectations since the user will not have to concern themselves with activating the IR illuminator in poorly lit conditions.

Usability

The Prima Facie Body Camera received a Usability score of 3.7. The following information is based on evaluator comments:

- Overall, the size and weight of the camera met expectations. When worn, it did not 'tug' on the user's uniform.
- The camera can be powered on/off fairly easily, with and without gloves, by pressing the power button on the side of the camera (Figure 4-2). The button must be held for a few seconds, which helps prevent accidental activation/deactivation. Starting and stopping recording was very easy, with and without gloves, using the record button on the front of the camera (Figure 4-3). However, this button might be easily activated/deactivated by mistake since it does not require the user to hold it down for any duration.

Figure 4-2. Prima Facie Body Camera Power Button

Figure 4-3. Prima Facie Body Camera Record Button

- Instant video playback was quick and easy on the camera's built-in display as well as using standard media players (e.g., Windows Media Player).

Deployability

The Prima Facie Body Camera received a Deployability score of 3.8. The following information is based on evaluator comments:

- The attachment options included with purchase met expectations. The clips feature teeth and were easily attached to the uniform. Overall, when the rotating clip mount was used, the camera remained in place while running; however, when the shoulder mount was used, the camera bounced around quite a bit while running.
- The camera appears durable and resistant to inclement weather. It is made of hard plastic and features shock-absorbing bumpers on each corner. In addition, all the ports are covered.

- The camera did not interfere with the seatbelt or with user maneuverability while conducting the daytime traffic stop and residential call scenarios.

4.2 TASER International Inc. AXON Flex

The AXON Flex (Figure 4-4) received an overall assessment score of 3.9 and costs $1,133 as assessed. A camera system (camera and controller); either a low rider headband mount or a mount for Oakley® glasses; two options for cables that connect the camera to the controller; a USB cable; an AC adapter; a holster with two belt clips for the controller; a single-bay docking station; Evidence Sync software; a basic EVIDENCE.com license for 1 year; 70 GB of EVIDENCE.com storage; and a hard copy of the quick-start guide were included with purchase. Electronic copies of the user manuals and quick-start guides are available from the vendor.

The following sections, broken out by SAVER category, summarize the assessment results.

Figure 4-4. AXON Flex

Capability

The AXON Flex received a Capability score of 3.9. The following information is based on evaluator comments:

- Overall, the recorded video was sharp and clear. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. In addition, it was evident in the residential call scenario video that the suspect had a weapon in her waistband.
- The low-light performance of the camera was very good even though it does not feature an IR illuminator. Although more grainy than what is captured in well-lit conditions, video captured during the nighttime traffic stop scenario as well as in the poorly lit areas of the residential call scenario was clear enough to permit recognition of people and objects.
- The camera captures a wider field of view than what was expected based on the specification; all cones appeared on the video captured during the daytime traffic stop scenario and a good portion of each room was captured on video during the residential call scenario despite the close quarters.
- The visual and audible system indicators met expectations. The controller beeps when recording is first initiated and the camera continuously beeps every two minutes while recording. The visual indicators are on the front of the controller, which could be difficult to see, depending on where the controller is worn. In covert mode, the lights on the controller do not illuminate and the beep from the camera can be silenced.

- It was easy to place the camera in covert mode by pressing and holding a button for 10 seconds; however, this button may be difficult to reach depending on where the controller is worn on the body (e.g., over or under uniform).
- The video is date and time stamped. Using EVIDENCE.com, the user can add information to the files including case number, notes, labels (e.g., traffic stop, misdemeanor), and tags.
- The camera's microphone is always on when capturing video.
- Data transfer was easy and quick as long as there is a strong internet connection. Data automatically starts uploading to EVIDENCE.com when the camera is placed in the dock.

Usability

The AXON Flex received a Usability score of 3.8. The following information is based on evaluator comments:

- Overall, the camera and controller were small and lightweight, which met expectations; however, having multiple wearable components was a bit cumbersome.
- The camera can be powered on/off very easily, with and without gloves, by activating a large switch at the top of the controller (Figure 4-5). Starting and stopping recording was very easy, with and without gloves, using the large button on the front of the controller (Figure 4-6). The button must be held down for a few seconds to stop recording once it is started, which aids in preventing accidentally stopping recording.

Figure 4-5. Axon Flex Power Switch

Figure 4-6. Axon Flex Record Button

- There is no display screen on the camera system for instant video playback; however, there is an option to view video on mobile devices using Bluetooth via Axon Mobile Android or iOS mobile applications (available at no charge). Video can be viewed with standard media players after it is transferred to vendor-provided software and saved in a standard format.
- The camera was worn on the head for this assessment. Therefore, it captured people and objects in the user's line of sight.

Deployability

The AXON Flex received a Deployability score of 3.9. The following information is based on evaluator comments:

- The attachment options for the camera included the low rider headband mount and a mount for a pair of Oakley glasses. These head mounted options permit the camera to capture the wearer's point of view. The cables running between the camera and the controller are breakaway cables and should not compromise officer safety. In addition, the camera easily connects to the attachment options via a magnet. The camera and controller remained in place while running.
- The camera system is made of hard plastic that seems to be durable. In addition, the camera seems resistant to inclement weather since the connectors have a rubberized lip that creates a seal when plugged in. The low rider headband mount and the Oakley glasses may easily be broken.
- The camera did not interfere with the seatbelt or with user maneuverability while conducting the daytime traffic stop and residential call scenarios.

4.3 Pinnacle Response Ltd. PR5

The PR5 (Figure 4-7) received an overall assessment score of 3.7 and costs $895 as assessed. A camera unit; a rotating clip mount; one fixed and one rotating KlickFast mount; a USB cable; AC and DC adapters; a Phillips head screwdriver; and a hard copy of the quick-start guide were included with purchase. An electronic copy of the quick-start guide is also available from the vendor.

Figure 4-7. PR5

The following sections, broken out by SAVER category, summarize the assessment results.

Capability

The PR5 received a Capability score of 3.8. The following information is based on evaluator comments:

- The recorded video was exceptionally sharp and clear, especially in well-lit conditions. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. While reviewing the daytime traffic stop scenario video, labels on the beer bottles were readable. In addition, it was evident in the residential call scenario video that the suspect had a weapon in her pocket.
- The low-light performance of the camera during the nighttime traffic stop scenario was exceptional; people and objects were clearly identifiable in the video. During review of the residential call scenario video, people and objects were a little difficult to see in the darkest room without a flashlight, but once the flashlight was used, the video was sharp and clear again.

- The camera captures a wide field of view; all cones appeared on the video captured during the daytime traffic stop scenario, and a wide area of each room was captured on video during the residential call scenario despite the close quarters.
- The visual indicators met expectations. The camera is powered on and recording starts when the camera door is slid open. A flashing green LED confirms that the camera is recording. This camera does not have a covert mode, and the green LED was sometimes visible during the nighttime traffic stop scenario.
- The video is stamped with the date, time, and serial number of the camera. Additional information cannot be added to the files by the user (e.g., case number).
- The camera's microphone is always on when capturing video.
- Data transfer was quick and easy. The camera connects to a computer via a USB cable and is recognized by the computer as an external device. Files open with Windows Media Player and the files are easily transferred to other locations on the computer.

Usability

The PR5 received a Usability score of 3.6. The following information is based on evaluator comments:

- The camera is bulky and the thickness of it, as well as that of the clip, results in it projecting too far from the chest while wearing. In addition, the camera felt heavy on the uniform.
- It is very easy to activate the camera and begin recording with and without gloves by sliding the camera door open (Figure 4-8). Although the door clicks in place when opened and closed, some evaluators noted the camera could be accidentally activated.
- There is no display screen on the camera for instant video playback; however, it is very quick and easy to view the video with standard media players.

Figure 4-8. PR5 Camera Door (Power and Recording Switch)

Deployability

The PR5 received a Deployability score of 3.6. The following information is based on evaluator comments:

- The rotating clip mount was easy to attach but the KlickFast mounts could not be used because no attachment option was included to attach to the uniform. The ball on the rotating clip mount permits the user to adjust the camera up, down, left, and right once the camera is clipped on the uniform. When running, the camera bounced around some and the ball joint on the rotating clip mount did not hold the camera's position, requiring it to be readjusted to be sure the camera was pointed in the desired direction.

- The camera is made of rubberized plastic that should resist shock if dropped. In addition, the camera appears resistant to inclement weather because all ports are covered.
- The camera did not interfere with user maneuverability while conducting the daytime traffic stop and residential call scenarios; however, the camera size interfered at times with getting the seatbelt on and off.

4.4 Black Mamba Protection LLC BMPpro+™

The BMPpro+ (Figure 4-9) received an overall assessment score of 3.7 and costs $1,025 as assessed. A camera unit; a rotating clip mount; a USB cable; AC and DC adapters; and BMPNest Lite software (standalone version) were included with purchase. An electronic version of the user manual is available from the vendor.

The following sections, broken out by SAVER category, summarize the assessment results.

Figure 4-9. BMPpro+

Capability

The BMPpro+ received a Capability score of 3.9. The following information is based on evaluator comments:

- The recorded video was sharp and clear. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. While reviewing the daytime traffic stop scenario video, labels on the beer bottles were readable. In addition, it was evident in the residential call scenario video that the suspect had a weapon in her pocket.
- The low-light performance of the camera during the nighttime traffic stop scenario (IR illuminator turned off) was good when light was present; people and objects were clearly identifiable when illuminated with the flashlight or the spotlight of the patrol car. During review of the residential call scenario video, people and objects were difficult to discern without the use of a flashlight until the IR illuminator was activated, at which point the video was clear again.
- The camera captures a wide field of view; all cones appeared on the video captured during the daytime traffic stop scenario, and a wide area of each room was captured on video during the residential call scenario despite the close quarters.
- Overall, the visual, audible, and tactile system indicators met expectations. The LED indicators can be seen by the wearer and the camera vibrates and beeps once when recording is started and again when it is stopped. When in covert mode, only the LCD is turned off; the status LEDs on the top of the camera remain illuminated and the audible indicator still beeps.
- It was easy to place the camera in covert mode with the press of a button for a few seconds; however, the button is difficult to locate and is not labeled for covert mode, which may require the user to reference the manual.

- The video is date and time stamped. The user can add additional information to the files including badge number and notes.
- The camera permits the user to capture audio only without video, which exceeded expectations. However, the audio record button is small and close to other buttons on the side of the camera; the buttons can be easily confused or a user could accidentally activate the wrong one while wearing gloves.
- Data transfer was quick and easy. The camera connects to a computer via a USB cable and is recognized by the computer as an external device. Files open with Windows Media Player, and the files are easily transferred to other locations on the computer. *Note: When the camera is configured for use with the optional software, the camera will not be recognized by the computer as an external device and the software will be required to access files saved on the camera. Since issues with the software were experienced during the assessment, the software could not be used when evaluators were assessing data transfer.*
- The camera features a manual IR illuminator that is easy to turn on/off with the press of a button. However, the button is small and close to other buttons on the side of the camera so it is difficult to locate without taking the camera off.

Usability

The BMPpro+ received a Usability score of 3.3. The following information is based on evaluator comments:

- The size and weight of the camera is a little more than what meets expectations. It is not extremely heavy but it is not lightweight either, and it is somewhat large.
- The power button (Figure 4-10) and record button (Figure 4-11) are small and close to other buttons on the camera so the user must look at the camera to be sure they are activating the correct button. Once the power button is located, the camera is easily powered on/off and recording is easily started/stopped both with and without gloves. There are no controls in place to prevent accidental activation/deactivation; however, this does not appear likely to happen due to the design (e.g., record button location).

Figure 4-10. BMPpro+ Power Button

Figure 4-11. BMPpro+ Record Button

- Video can be played back directly on the camera; however, the steps to playback video were not very intuitive at first but would likely become easier with continued use of the camera. It was quick and easy to view video with standard media players.

Deployability

The BMPpro+ received a Deployability score of 3.7. The following information is based on evaluator comments:

- The rotating clip mount permitted the user to easily attach the camera to different areas on the uniform. The weight of the camera may have been too much for the clip since the camera bounced around while running.
- The camera appears durable and resistant to inclement weather since it features covered ports and rubber buttons.
- The camera did not interfere with the seatbelt or with user maneuverability while conducting the daytime traffic stop and residential call scenarios.

4.5 VIEVU LLC LE3

The LE3 (Figure 4-12) received an overall assessment score of 3.7 and costs $899 as assessed. A camera unit; two chest clip mounts; a lapel-pin mount; an AC charger; a proprietary USB download cable; and a hard copy of the quick-start guide were included with purchase. An electronic version of the quick-start guide is also available from the vendor.

The following sections, broken out by SAVER category, summarize the assessment results.

Figure 4-12. LE3

Capability

The LE3 received a Capability score of 3.5. The following information is based on evaluator comments:

- Overall, the recorded video was sharp and clear. For the most part, people and objects were identifiable in both the daytime traffic stop and residential call scenarios. While it was evident in the residential call scenario video that the suspect had a weapon, video captured inside the vehicle during the daytime traffic stop scenario appeared a little grainy.
- Video captured during the nighttime traffic stop was grainy and resulted in people and objects being difficult to identify at times. During review of the residential call scenario video, it was obvious that the camera had difficulty adjusting to changes in lighting (i.e., green tint in video) and people and objects in poorly-lit areas were difficult to see without the use of a flashlight.
- The field of view captured on video was narrower than expected in both the daytime traffic stop and residential call scenarios.
- The visual indicators met expectations. The camera is powered on and recording starts when the camera door is slid open. A flashing green LED confirms that the camera is recording. This camera does not have a covert mode; however, the flashing green LED is small and not noticeable unless you are close to the camera.

- The video is date and time stamped in Greenwich Mean Time (GMT), which cannot be changed. The user can add additional information to the files including a case number and notes.
- The camera's microphone can be disabled with the software during setup and there is no microphone control on the camera.
- Data transfer was quick and easy. The camera connects via a proprietary USB download cable and must be plugged into two USB ports on the computer. Step-by-step instructions that walk through the transfer process are provided by the software once the camera is connected.

Usability

The LE3 received a Usability score of 3.8. The following information is based on evaluator comments:

- The camera is small and lightweight and does not pull on the user's uniform.
- It is very easy to activate the camera and begin recording with and without gloves by sliding the camera door open (Figure 4-13). It would be difficult to accidentally activate/deactivate the camera due to its low profile.
- There is no display screen on the camera for instant video playback; however, video could be viewed with standard media players without issue.

Figure 4-13. LE3 Camera Door (Power and Recording Switch)

Deployability

The LE3 received a Deployability score of 4.0. The following information is based on evaluator comments:

- The attachment options met expectations. The chest clip mount could rotate and was easily attached to different areas on the uniform. In addition, the clip was sufficient to hold the camera in place while running.
- The camera is made of rubberized plastic that should resist shock if dropped. In addition, the camera appears resistant to inclement weather because the only port, which is located on the bottom of the camera, is covered.
- The camera did not interfere with the seatbelt or with user maneuverability while conducting the daytime traffic stop and residential call scenarios.

4.6 Digital Ally Inc. FirstVu™ HD

The FirstVu HD (Figure 4-14) received an overall assessment score of 3.7 and costs $795 as assessed. A camera system (camera and DVR); three camera mounts (Velcro mount, fabric clip, and button mount); two USB cables; a battery charger; AC and DC adapters; two proprietary batteries (only one is required for operation); and a VuVault software disc were included with purchase. In addition, an electronic copy of the user manual and quick-start guide were stored on the DVR.

Figure 4-14. FirstVu HD

The following sections, broken out by SAVER category, summarize the assessment results.

Capability

The FirstVu HD received a Capability score of 3.6. The following information is based on evaluator comments:

- The recorded video was sharp and clear. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. In addition, it was evident in the residential call scenario video that the suspect had a weapon.
- Overall, the low-light performance of the camera during the nighttime traffic stop scenario provided clear images. During review of the residential call scenario video, people and objects in the darkest areas were difficult to discern without the use of a flashlight since this camera is not equipped with an IR illuminator.
- Overall, the camera captured a wide field of view during the daytime traffic stop and residential call scenarios.
- Overall, the visual, audible, and tactile system indicators met expectations. In standby mode, the LEDs on the DVR flash and the DVR vibrates during startup. Once recording is initiated, a red LED on the top of the camera is illuminated and visible to the wearer. In addition, the DVR vibrates every 15 seconds to indicate it is still recording. The red LED on the camera is deactivated when the camera is placed in covert mode.
- Placing the unit in covert mode requires the use of software, which may be a problem during field operations.
- The video is date and time stamped. When the video was tagged during the scenario (i.e., momentarily press record button while recording), the marks on the video were accurately placed on the playback bar during playback.
- The camera's microphone can easily be turned on and off while recording because the switch is accessible on the side of the camera. It is the only switch on that side and it is easy to tell if it is on or off.
- Data transfer was somewhat difficult due to issues with the software freezing and data transfer taking longer than expected.

Usability

The FirstVu HD received a Usability score of 3.5. The following information is based on evaluator comments:

- Overall, the camera and DVR were small and lightweight, which met expectations; however, having multiple wearable components was a bit cumbersome.
- Powering the camera on/off was easy using the power switch on the DVR (Figure 4-15); however, some users may need to remove their gloves in order to manipulate the small switch. It is easy to start/stop recording with and without gloves by pressing the large record button on the camera (Figure 4-16). Since the button must be held for a couple seconds to stop recording, it is less likely for the user to accidentally stop recording.

Figure 4-15. FirstVu HD Power Switch (on DVR)

Figure 4-16. FirstVu HD Record Button (on Camera)

- There is no display screen for instant video playback. Video can be played using standard media players but some evaluators had difficulty with this working properly. There is an optional application available for an additional cost (VuVault Go) that permits users to view video and sync with the in-car camera (if compatible system) over Wi-Fi®.

Deployability

The FirstVu HD received a Deployability score of 4.1. The following information is based on evaluator comments:

- The camera easily attaches with the fabric clip mount. The DVR is worn inside the pocket of the uniform and an additional mounting option would need to be purchased to wear the DVR elsewhere. The cable running between the camera and the controller is a breakaway cable and should not compromise officer safety. The camera and DVR remained in place while running.
- The camera and DVR appear durable and resistant to inclement weather. The camera and DVR are coated in rubber, the ports on the DVR are covered, and the connections appear watertight.
- The camera did not interfere with the seatbelt or with user maneuverability while conducting the daytime traffic stop and residential call scenarios.

4.7 Wolfcom Enterprises Wolfcom® 3rd Eye Police Body Camera

The Wolfcom 3rd Eye Police Body Camera (Figure 4-17) received an overall assessment score of 3.3 and costs $675 as assessed. A camera unit; an epaulette clip; a vest clip; an HDMI cable; a USB cable; an AC adapter; and Wolfcom Management Software were included with purchase. Electronic versions of the user manuals are available from the vendor.

The following sections, broken out by SAVER category, summarize the assessment results.

Figure 4-17. Wolfcom 3rd Eye Police Body Camera

Capability

The Wolfcom 3rd Eye Police Body Camera received a Capability score of 3.8. The following information is based on evaluator comments:

- The recorded video was exceptionally sharp and clear in all lighting conditions. People and objects were clearly identifiable in both the daytime traffic stop and residential call scenarios. In addition, it was evident in the residential call scenario video that the suspect had a weapon in her pocket.
- The low-light performance of the camera during the residential call scenario exceeded expectations with the IR illuminator activated; people and objects were easily seen on the video when in complete darkness. When the IR illuminator was off, people and objects in the residential call scenario were a little difficult to see in the darkest room without a flashlight. During review of the nighttime traffic stop scenario (IR illuminator turned off), people and objects were clearly identifiable in the video.
- The camera captures a wide field of view; both the driver and passenger were captured on video during the daytime traffic stop scenario, and a wide area of each room was captured on video during the residential call scenario despite the close quarters.
- The camera features both audible and visual indicators for standby mode and recording; however, the red LED indicator that illuminates while recording is small and located on the side of the camera, making it difficult for the wearer to see without adjusting the camera. No illumination was observed from the camera while in covert mode during the nighttime traffic stop.

Figure 4-18. Wolfcom 3rd Eye Police Body Camera Toggle Joystick

- The camera is placed in covert mode by turning off the LCD using the toggle joystick (Figure 4-18); however, this was not easy to figure out and the information on how to turn off the display was difficult to find in the user manual.

- The video is stamped with the date, time, and badge number (preconfigured in setup). GPS information is also stamped on the video and additional information can be added to the files by the user (e.g., case number).
- The camera permits the user to capture audio only, and audio can be disabled in the camera menu during setup. However, the toggle joystick on the back must be used to select audio features and the user manual had to be referenced.
- Data transfer was quick and easy. The camera connects via a USB cable and step-by-step instructions that walk the user through the transfer process are provided by the software.
- The camera features a manual IR illuminator that is easy to turn on/off using the toggle on the front of the camera. However, an automatic IR is generally preferred and it is difficult to tell if the toggle for the IR illuminator is in the on or off position.

Figure 4-19. Wolfcom 3rd Eye Police Body Camera OTR Switch

Usability

The Wolfcom 3rd Eye Police Body Camera received a Usability score of 2.8. The following information is based on evaluator comments:

- The camera is bulky and the thickness of it, as well as that of the clip (Figure 4-19), results in it projecting too far from the chest while wearing. In addition, the camera pulls on the uniform.
- The multiple ways to power on the camera and initiate recording were confusing. The one-touch recording (OTR) switch on the side of the camera (Figure 4-19) powered on the camera and started recording when activated; however, the sequence required to stop recording (e.g., move switch up, down, and up again) was confusing. The camera can also be powered on by pressing a small power button on the back of the camera, and recording can be started/stopped by pressing the small record button on the back of the camera (Figure 4-20). These buttons are almost identical in size and grouped with multiple buttons on the back of the camera, making it easy for the user to accidentally press the wrong button. Operation of the controls while wearing gloves was difficult due to the small size of the OTR switch and buttons on the back of the camera.

Figure 4-20. Wolfcom 3rd Eye Police Body Camera Record and Power Buttons

- Instant video playback was quick and easy on the camera's built-in display as well as using standard media players.

Deployability

The Wolfcom 3rd Eye Police Body Camera received a Deployability score of 2.6. The following information is based on evaluator comments:

- The attachment options are plastic and did not appear very sturdy at the contact points. The epaulette clip features plastic threading that has questionable durability and the vest clip may be prone to breakage because it holds the camera too far from the user's body. While easy to attach, the vest clip does not support the weight of the camera, resulting in the camera being angled down once it is attached to the uniform. The camera bounced around while running and did not stay in place.
- The camera is made of hard plastic and, while it appears rugged and able to withstand inclement weather, its attachment point with the clip is a weak point that appears prone to breakage. In addition, the switches and buttons on the camera did not seem durable.
- The camera did not interfere with user maneuverability while conducting the daytime traffic stop and residential call scenarios. However, the camera size interfered at times with getting the seatbelt on and off and, when the camera was hit with the seatbelt, the ball joint on the mount would not hold the camera in place, requiring it to be readjusted to ensure it was pointing in the desired direction.

5. SUMMARY

Body-worn video cameras are valuable tools that can be used by law enforcement to record traffic stops, arrests, sobriety tests, and interviews. Evaluators noted that body-worn cameras with exceptional low-light performance may be able to see better than the person wearing them, and that there are pluses and minuses that correlate with that. They also noted that, regardless of available attachment options, users will need to adapt how they typically position their body to be sure they are capturing what they intend to capture in the camera's field of view (e.g., a bladed body position will not capture what the user is looking at on a chest-mounted camera). In general, the more features on a camera (e.g., display screen), the heavier and bulkier it tends to be. Evaluators agreed that all of the assessed body-worn video cameras had audio quality that met expectations. Additional advantages and disadvantages for the assessed products are highlighted in Table 5-1.

Emergency responder agencies that consider purchasing body-worn video cameras should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

Table 5-1. Product Advantages and Disadvantages

Vendor/Product	Advantages	Disadvantages
 Safety Vision LLC Prima Facie Body Camera MSRP: $579 (as assessed) Overall Score: 3.9	• Automatic IR illuminator. • Option to record audio only. • Push-to-talk (PTT) feature to integrate with police radio. • If used as a shoulder microphone with police radio, the camera is less obvious. • Audio can be muted on the camera while recording. • User-friendly and compact; a large number of features/options but not overly complicated or large.	• Could accidentally start/stop recording since button only requires momentary press.
 TASER International Inc. AXON Flex MSRP: $1,133 (as assessed) Overall Score: 3.9	• Constant reminder that it is recording (camera beeps every 2 minutes). • Captures point of view (head mounted). • Video is viewable on mobile devices using Bluetooth via Axon Mobile Android or iOS mobile applications. • Dock and go capability; charges and transfers at end of shift. • Extend operational time with use of additional controllers. • Large button for camera activation results in 'no look' activation.	• Cable between camera and controller is a bit cumbersome.
 Pinnacle Response Ltd. PR5 MSRP: $895 (as assessed) Overall Score: 3.7	• Easy on/off; recording when camera door is open. • Easy to tell it is recording. • Easily deployed; would require minimal/no training. • Exceptional image quality, especially in good lighting conditions. • Brightly colored CCTV marking on the camera makes it obvious to others that they are being recorded.	• No video tagging capability. • Ball joint clip requires frequent adjustment. • The green flashing LED cannot be turned off for covert operations. • Not very discreet (i.e., CCTV on front of camera). • No USB security (any computer will recognize device as an external drive).

Vendor/Product	Advantages	Disadvantages
 Black Mamba Protection LLC BMPpro+ MSRP: $1,025 (as assessed) Overall Score: 3.7	• Has an IR illuminator. • Option to record audio only. • PTT feature to integrate with police radio. • If used as a shoulder microphone with police radio, the camera is less obvious.	• IR illuminator is manually controlled; prefer automatic. • Buttons are too small and close together. • No USB security unless optional software is purchased (i.e., BMPNest or BMPNest Lite).
 VIEVU LLC LE3 MSRP: $899 (as assessed) Overall Score: 3.7	• Easy on/off; recording when camera door is open. • Easy to tell it is recording. • Easily deployed; would require minimal/no training. • Audio can be disabled in the software during setup. • Compact and lightweight.	• Narrow field of view. • Grainy image quality, especially in low-light conditions. • Green tint noticeable on video when transitioning between lighting conditions.
 Digital Ally Inc. FirstVu HD MSRP: $795 (as assessed) Overall Score: 3.7	• User-replaceable battery. • Constant reminder that it is recording (vibrates every 15 seconds and red LED easily seen by wearer). • Red LED on camera can be turned off when in covert mode. • Audio can be muted on the camera while recording. • Optional application available for additional cost (VuVault Go) to view video and sync with in-car camera over Wi-Fi. • Camera is discreet.	• Cable between camera and DVR is a bit cumbersome. • Accessory (extension cable and pouch) required for alternate mounting options for DVR; must wear in pocket.
 Wolfcom Enterprises Wolfcom 3rd Eye Police Body Camera MSRP: $675 (as assessed) Overall Score: 3.3	• Has an IR illuminator. • Option to record audio only. • PTT feature to integrate with police radio. • If used as a shoulder microphone with police radio, the camera is less obvious. • Audio can be disabled in the camera menu during setup. • Exceptional image quality in all lighting conditions. • Option to sync with in-car camera system for an additional cost.	• IR illuminator is manually controlled; prefer automatic. • Clip is prone to breakage because it projects out so far. • Control buttons are overly complicated. • Plastic threaded epaulette clip has questionable durability. • Small red LED recording indicator is located on side of camera so unable to see while wearing. • Did not stay in place while running.

APPENDIX A. EVALUATION CRITERIA DEFINITIONS

The focus group identified 25 evaluation criteria, which are defined as follows.

CAPABILITY

Image Quality refers to the system's ability to provide a sharp, clear image with minimal distortion so the user can identify people and/or objects. Image quality is typically affected by video resolution and frame rate, as well as digital enhancement and image stabilization options.

Low-Light Capability refers to the system's ability to provide a sharp, clear image with minimal distortion so the user can identify people and/or objects in low-light conditions. The focus group noted that options such as a low lux camera, infrared light, and black-and-white mode may improve the ability of the camera to record in low-light conditions.

Power refers to the type and number of batteries required to power the system, and whether the batteries are proprietary or commonly available. Power also includes battery runtime and, if applicable, the number of times rechargeable batteries can be recharged before replacement is recommended.

Data Storage refers to the capacity and type of data storage included with system purchase. The capacity determines the length of time the system can record. Data Storage also includes upgradeable storage options, if applicable, and the maximum amount of storage the system can accommodate.

Field of View refers to the image width and height that is captured on video at a given distance.

System Indicators refers to whether the body-worn camera system can inform the user of system status (e.g., low battery, full capacity, recording) visually, audibly, or by vibration. The focus group noted that any indicators on the camera should not compromise the user's safety by revealing his or her location during covert operations.

Audio Quality refers to the clarity of the audio during playback. Focus group participants noted that stereo is preferred.

Data Security refers to software features that protect data integrity, such as data rights management, chain of custody records, and video authentication. In addition, focus group participants noted that removable storage media could compromise data security since this type of media could be removed, misplaced, and/or destroyed.

Video Tagging refers to the ability of the system to automatically capture metadata (e.g., date/time stamp, GPS coordinates), as well as permit users to add additional metadata, such as a case number and case notes.

Microphone Options refers to characteristics of the microphone, such as whether or not it is built-in, external, and/or detachable, as well as a control to turn the microphone on and off manually.

Data Transfer refers to the method by which data is moved from the system to an external device (e.g., cables, wireless, removable media card). Data Transfer also includes the data transfer rate (i.e., how quickly the data can be transferred to another device) and, if wireless, the method of data encryption and standard protocols used during wireless transfer.

Streaming Video refers to the ability of the system to wirelessly transmit video and audio in real-time for viewing. Focus group participants noted the importance of data encryption and standard protocols during wireless transfer.

Illumination Control refers to whether the illumination (e.g., white light, LEDs) can be manually controlled.

USABILITY

Physical Characteristics refers to the size, weight, and color of the system's wearable components.

Camera Activation refers to how easily the system can be purposely turned on and off, as well as if it can be activated with gloves on. Focus group participants noted a preference for controls that prevent accidental activation/deactivation of the camera.

Instant Video Playback refers to how easily users can view recorded video. Focus group participants noted the importance of being able to view video immediately as well as export data in standard formats, such as .AVI and .MPG.

Point of View refers to the ability of the camera to capture subjects and objects in the user's line of sight.

Software Requirements refers to the software that is used with the body-worn camera as well as if it is proprietary or uses common media players. Software Requirements also includes the operating system requirements.

DEPLOYABILITY

Attachment Options refers to the methods by which system components can be worn by the user. A system's wearable components may be worn on the user's clothing, head, and/or ear. Focus group participants noted that system components should feature breakaway cables/connections for officer safety.

Durability refers to the overall sturdiness of the camera and other body-worn components. Focus group participants noted the importance of the system's resistance rating to shock, vibration, weather, and water. In addition, participants added that resistance to water and weather may be improved if the system utilizes connectors that are watertight.

Operating/Storage Temperature refers to the minimum and maximum operating and storage temperatures of the body-worn camera system. The focus group participants preferred the widest possible temperature ranges due to the temperature extremes experienced during operation and storage.

Interference refers to system components not becoming entangled with objects, such as seatbelts and officer equipment, when the user is performing daily operations (e.g., getting in and out of a car, walking, running).

MAINTAINABILITY

Recharge Method/Time refers to the method by which the battery is recharged (e.g., cradle, USB) and the amount of time required to fully recharge the battery.

Battery Access refers to the physical attributes of the battery compartment, including whether or not tools are required for battery replacement.

AFFORDABILITY

Value refers to the components, accessories, warranty, technical support, and training options included with system purchase. Value also includes recurring costs for extended support, software/firmware updates, and extended warranty options.

APPENDIX B. EVALUATION CRITERIA CONSIDERATIONS

Criteria	Product Familiarization Scenario	Nighttime Traffic Stop Scenario	Daytime Traffic Stop and Residential Call Scenarios	Considerations
Image Quality			✓	Does the video recorded by the body-worn camera system provide a sharp, clear image with minimal distortion? During the traffic stop scenario, how easily can the driver, passenger, and objects inside the vehicle be identified in the video? During the residential call scenario, how easily can the individuals and objects inside the building be identified in the video?
Low-Light Capability		✓	✓	Does the video recorded by the body-worn camera system provide a sharp, clear image in low-light conditions? How easily can people and/or objects be identified in the video that is recorded in low-light conditions?
Field of View			✓	Does the field of view that is captured on the video during the traffic stop scenario meet expectations? Does the field of view that is captured on the video during the residential call scenario meet expectations?
System Indicators	✓			Do the system indicators for power/standby and audio on/off meet expectations? Do the system indicators for recording status meet expectations?
	✓	✓		How covert do the system indicators appear?
			✓	How easy is it to tell the camera is powered on and in standby mode based on system indicators? How easy is it to tell the camera is recording based on system indicators?

Criteria	Product Familiarization Scenario	Nighttime Traffic Stop Scenario	Daytime Traffic Stop and Residential Call Scenarios	Considerations
Audio Quality			✓	Does the clarity of the audio meet expectations? Does the stereo effect meet expectations?
Video Tagging			✓	Do the date/time stamp and/or other information provided by the system meet expectations? Does additional information that can be added to the video meet expectations?
Microphone Options	✓			Do the characteristics of the microphone (e.g., built-in, external, detachable) meet expectations? If equipped, does the microphone's control meet expectations?
Data Transfer			✓	Does the method by which data is transferred (e.g., cables, wireless, removable media card) from the body-worn camera system to an external device meet expectations? Does the speed of data transfer meet expectations?
Illumination Control	✓			Does the body-worn camera system feature automatic or manually controlled illuminator(s)? If manual, does the ease of using the control and the functions of the control meet expectations?
Physical Characteristics	✓			Do the size, weight, and color of the camera and wearable components meet expectations?
Camera Activation	✓			How easily can the camera be activated? How easy is it to activate recording? How easily can the camera be powered off?
			✓	How easily can the camera be activated while wearing gloves? Do the controls that prevent accidental activation/deactivation of the camera meet expectations? How easy is it to activate recording while wearing gloves? How easily can the camera be powered off while wearing gloves?

Criteria	Product Familiarization Scenario	Nighttime Traffic Stop Scenario	Daytime Traffic Stop and Residential Call Scenarios	Considerations
Instant Video Playback			✓	How quick and easy is it to play back video on the camera?
			✓	Can video be reviewed using standard media players?
Point of View			✓	Are subjects and objects within the user's line of sight captured on the video?
Attachment Options	✓			Do the methods by which the camera system can be worn meet expectations? Do the wearable components of the camera system feature breakaway cables/connections for officer safety? How easily can the wearable components be attached?
			✓	How well do the wearable components remain in place while running?
Durability	✓			Does the overall sturdiness of the camera and wearable components meet expectations? Do the camera and wearable components appear resistant to inclement weather? If applicable, do connections appear watertight?
Interference			✓	Does the camera or other wearable components interfere with the seatbelt when getting in the vehicle? Does the camera or other wearable components interfere with the seatbelt when getting out of the vehicle? Does the camera or other wearable components interfere with user maneuverability?

APPENDIX C. ASSESSMENT SCORING FORMULAS

The overall score for each product was calculated using the product's averaged criterion ratings and category scores. An average rating for each criterion was calculated by summing the evaluators' ratings and dividing the sum by the number of responses. Category scores for each product were calculated by multiplying the average criterion rating by the weight assigned to the criterion by the focus group, resulting in a weighted criterion score. The sum of the weighted criterion scores was then divided by the sum of the weights for each criterion in the category as seen in the formula and example below.

Category Score Formula

$$\frac{\sum\left(Average\ Criterion\ Rating \times Criterion Weight\right)}{\sum\left(Criterion Weights\right)} = \begin{matrix} Category \\ Score \end{matrix}$$

Category Score Example[1]

$$\frac{\left(4.3\times 4\right)+\left(5\times 4\right)+\left(4\times 3\right)+\left(4.5\times 3\right)+\left(4.5\times 3\right)}{4+4+3+3+3} = 4.5$$

To determine the overall assessment score for each product, each category score was multiplied by the percentage assigned to the category by the focus group. The resulting weighted category scores were summed to determine an overall assessment score as seen in the formula and example below.

Overall Score Formula

$$\sum\left(Category\ Score \times Category\ Percentage\right) = \begin{matrix} Overall\ Assessment \\ Score \end{matrix}$$

Overall Score Example[1]

Capability	*Usability*	*Affordability*	*Maintainability*	*Deployability*	
$\left(4.0\times 33\%\right)$	+ $\left(4.2\times 27\%\right)$	+ $\left(4.2\times 20\%\right)$	+ $\left(3.8\times 10\%\right)$	+ $\left(4.5\times 10\%\right)$	= 4.1

[1]Examples are for illustration purposes only. Formulas will vary depending on the number of criteria and categories assessed and the criteria and category weights.