



# Body Worn Cameras with Automatic Activation

## Assessment Report

July 2023



Science and  
Technology





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## FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of federal, state, local, tribal, and territorial responders to address the homeland security mission. The laboratory assists responders with the use of technology to prevent, protect against, mitigate, respond to, and recover from homeland security threats and incidents. NUSTL provides expertise on a wide range of subject areas, including chemical, biological, radiological, nuclear, and explosive detection, personal protective equipment, and tools for emergency response and recovery.

NUSTL manages the System Assessment and Validation for Emergency Responders (SAVER) program, which provides information on commercially available equipment to assist response organizations in equipment selection and procurement. SAVER 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?” The SAVER program works with responders to conduct objective, practitioner-relevant, operationally-oriented assessments and validations of commercially available emergency response equipment. Having the right tools provides a safer work environment for responders and a safer community for those they serve.

NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, and coordinating with other organizations to leverage appropriate subject matter expertise. In conjunction with DAGER Technology, LLC, NUSTL conducted an assessment of commercially available body worn cameras with automatic activation. Body worn cameras fall under AEL reference number [13LE-00-SURV](#) titled “Equipment, Law Enforcement Surveillance.”

SAVER reports are available at [www.dhs.gov/science-and-technology/saver](http://www.dhs.gov/science-and-technology/saver).

Visit the NUSTL website at [www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory](http://www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory), or contact the lab at [NUSTL@hq.dhs.gov](mailto:NUSTL@hq.dhs.gov).





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## EXECUTIVE SUMMARY

Emergency responders use body worn cameras (BWCs) with automatic activation to record their actions as well as their interactions with fellow responders and the public while on duty. BWCs can be used by all responder disciplines to ensure transparency, deter aggressive behavior, preserve evidence, monitor personnel, document interactions, aid in the accuracy of written reports, provide a training tool for professional development, and aid in improving operational procedures.

From September 19–22, 2022, the Systems Assessment and Validation for Emergency Responders (SAVER) program conducted an operational assessment of commercially available BWCs with automatic activation at the New York State Department of Homeland Security and Emergency Services State Preparedness Training Center in Oriskany, New York. This assessment focused specifically on BWCs that could be activated via holster or vehicle sensors.

Nine subject matter expert first responders, each with at least five years of experience, served as evaluators. They assessed four different BWCs as well as three holster sensors and three vehicle sensor demonstration kits according to specifications and in operational scenarios. The cameras and holster activation sensors were evaluated and received separate scores. For sensors triggered by engaging vehicle emergency lights and/or sirens, only demonstration kits could be used at the assessment because test vehicles did not allow for hardwire installation. As such, they were assessed but not scored. Qualitative feedback on these sensors as well as the cameras and holster sensors, is included in this report.

Evaluators concluded that one camera met all of their expectations, while the other three cameras met most of their expectations. Overall scores for the BWCs ranged from 3.3 to 4.1 on a five-point scale. The tables below present the overall scores as well as the category scores for each BWC and holster activation sensor. Products are listed in order from highest to lowest overall score.

The purpose of this assessment report is to provide emergency responders with information that will guide their agencies in making operational and procurement decisions. Emergency responder agencies should consider overall capabilities, technical specifications, and limitations of BWCs in relation to their agency's operational needs when making equipment selections. Agencies should also consider impacts associated with integrating this equipment into their power and information technology infrastructure, data management, concept of operations, and required maintenance.



**Body Worn Cameras Scores Summary Table**

Product	Overall Score	Overall	Capability	Deployability	Usability	Maintainability	Affordability
Axon Enterprises Body 3		4.1	4.1	4.2	4.0	4.2	3.8
Utility BodyWorn (EOS)		3.7	3.7	3.8	3.4	3.8	4.0
Motorola V300		3.6	3.1	3.9	3.9	4.0	4.0
Motorola VB400		3.3	3.1	3.8	2.9	3.9	3.6

*Key: 1 (least favorable) to 5 (most favorable)*

**Holster Activation Sensor Scores Summary Table**

Product	Overall Score	Overall	Capability	Usability	Deployability
Axon Enterprises Signal Sidearm		3.8	3.7	4.0	3.9
Motorola Yardarm Holster Aware		3.7	4.0	3.6	3.6
Utility Smart Holster Sensor		3.6	3.4	4.2	3.6

*Key: 1 (least favorable) to 5 (most favorable)*



## TABLE OF CONTENTS

1.0 Introduction.....	5
1.1 Participant Information .....	5
1.2 Assessed Products .....	5
2.0 Evaluation Criteria .....	7
3.0 Assessment Methodology .....	10
3.1 Phase 1: Specification Assessment .....	10
3.2 Operational Assessment .....	11
3.2.1 Emergency Light and Proximity Automatic Activation.....	11
3.2.2 Unholstering Firearm Automatic Activation and Visual Acuity .....	11
3.2.3 Mock Room Clearing Scenario .....	12
3.3 Data Gathering and Analysis .....	13
4.0 Body Worn Camera Results .....	14
4.1 Axon, Body 3 .....	16
4.1.1 Capability .....	16
4.1.2 Deployability .....	17
4.1.3 Usability .....	18
4.1.4 Maintainability.....	18
4.1.5 Affordability.....	19
4.2 Utility, BodyWorn (EOS) .....	19
4.2.1 Capability .....	20
4.2.2 Deployability .....	22
4.2.3 Usability .....	22
4.2.4 Maintainability.....	23
4.2.5 Affordability.....	23
4.3 Motorola, V300.....	23
4.3.1 Capability .....	24
4.3.2 Deployability .....	26
4.3.3 Usability .....	27
4.3.4 Maintainability.....	28
4.3.5 Affordability.....	28
4.4 Motorola, VB400 .....	29
4.4.1 Capability .....	29
4.4.2 Deployability .....	31



4.4.3 Usability .....	31
4.4.4 Maintainability.....	32
4.4.5 Affordability.....	32
5.0 Holster Sensor Results.....	33
5.1 Axon, Signal Sidearm .....	35
5.1.1 Capability .....	35
5.1.2 Usability .....	35
5.1.3 Deployability .....	35
5.2 Yardarm Holster Aware .....	36
5.2.1 Capability .....	36
5.2.2 Usability .....	36
5.2.3 Deployability .....	36
5.3 Utility, Smart Holster Sensor.....	37
5.3.1 Capability .....	37
5.3.2 Usability .....	37
5.3.3 Deployability .....	37
6.0 Vehicle And Proximity Sensor Feedback.....	38
6.1 Axon, Signal Vehicle .....	38
6.2 Motorola, V300 Vehicle Kit.....	38
6.3 Utility, Vehicle Sensor.....	39
7.0 Summary .....	40
8.0 Acknowledgements .....	43
9.0 References.....	44





## LIST OF FIGURES

Figure 3-1 Familiarization sessions of Axon (top), Motorola (center) and Utility (Bottom) .....	10
Figure 3-2 Emergency Light Activation Scenario .....	11
Figure 3-3 An evaluator with an unholstered mock weapon proceeds to a visual acuity chart. ....	12
Figure 3-4 Two evaluators with activated body worn cameras clear a room.....	12
Figure 4-1 Axon Body 3.....	16
Figure 4-2 Frame pulled from the Axon Body 3 .....	17
Figure 4-3 An evaluator prepares to activate the Body 3 via its event button. ....	18
Figure 4-4 Utility’s BodyWorn (top) and its wrist-mounted controller (bottom).....	19
Figure 4-5 The BodyWorn mounting bracket.....	20
Figure 4-6 Screenshot Image from the BodyWorn’s footage.....	21
Figure 4-7 BodyWorn’s Smart Holster sensor .....	21
Figure 4-8 An evaluator places a BodyWorn camera into a Utility brand vest.....	22
Figure 4-9 Evaluators paired the BodyWorn with the wrist-mounted BlueTooth controller.....	22
Figure 4-10 Motorola V300 mounted to a vest .....	23
Figure 4-11 Motorola V300 Mounting Options .....	26
Figure 4-12 Motorola V300 has its power button on the bottom of the BWC. ....	27
Figure 4-13 Motorola V300 has its power button on the bottom of the BWC. ....	27
Figure 4-14 Motorola VB400.....	29
Figure 4-15 Video frame from the Motorola V400 BWC during the room clearing scenario.....	30
Figure 4-16 Motorola VB400 Layout .....	31
Figure 5-1 Axon Signal Sidearm sensor.....	35
Figure 5-2 Yardarm Holster Aware sensor affixed to the holster and on a desktop .....	36
Figure 5-3 Utility Smart Holster sensor affixed to the holster and laying on a desktop.....	37
Figure 6-1 Axon Signal Vehicle demonstration sensor .....	38
Figure 6-2 Motorola V300 vehicle kit demonstration sensor .....	38
<b>Figure 6-3 Utility vehicle sensor demonstration unit.....</b>	<b>39</b>
Figure 6-4 Evaluators test proximity activation sensors of the Axon Body 3.....	39
Figure 6-5 Evaluators wearing the Utility BodyWorn approach a simulated broken down vehicle. ....	39
Figure 6-6 Evaluators simulate a wellness check while assessing vehicle sensor activation with the Motorola V300. ....	39
Figure 6-7 An evaluator conducts a wellness check while his Axon Body 3 camera is activated.....	39



## LIST OF TABLES

Table 1-1 Evaluators' Professional Backgrounds .....	5
Table 1-2 Assessed Products' Key Specifications .....	6
Table 2-1 Evaluation Criteria .....	8
Table 4-1 Assessment Results .....	14
Table 4-2 Evaluation Criteria Ratings .....	15
Table 5-1 Holster Sensor Assessment Results .....	33
Table 5-2 Evaluation Criteria Ratings .....	34
Table 7-1 Body-Worn Camera Advantages and Disadvantages .....	40
Table 7-2 Holster Sensor Advantages and Disadvantages .....	42

## 1.0 INTRODUCTION

From September 19–22, 2022, the National Urban Security Technology Laboratory’s (NUSTL) System Assessment and Validation for Emergency Responders (SAVER) program, with the support of DAGER Technology, LLC (DAGER), conducted an assessment of body worn cameras (BWC) with automatic activation capabilities, specifically activation by unholstering a firearm and by engaging vehicle emergency lights/sirens. The assessment took place at the New York State Department of Homeland Security and Emergency Services State Preparedness Training Center (SPTC) in Oriskany, New York. NUSTL held the assessment to obtain hands-on feedback on BWCs that will help response agencies make operational and procurement decisions.

Assessment activities and evaluation criteria were based on recommendations from a focus group of responders. A report on that focus group and additional publications on this technology can be found in the SAVER Document Library on the page devoted to “Automatic Activation of Body Cameras” at [www.dhs.gov/science-and-technology/saver/st-automatic-activation-body-cameras](http://www.dhs.gov/science-and-technology/saver/st-automatic-activation-body-cameras).

### 1.1 Participant Information

Nine emergency responders assessed the BWC and automatic activation sensors following assessment procedures developed by NUSTL. Evaluators were selected for the assessment based on their respective geographic location, discipline, and professional experience as well as their operational experience using BWC. Each participant’s professional information is listed in Table 1-1.

Table 1-1 Evaluators’ Professional Backgrounds

Evaluator Discipline	Years of Experience	State
Law Enforcement	15–20	CA
Law Enforcement	5–10	CO
Law Enforcement	10–15	FL
Law Enforcement	15–20	GA
Law Enforcement	25–30	NC
Law Enforcement	15–20	NY
Law Enforcement	35–40	OK
Law Enforcement	20–25	PA
Law Enforcement	15–20	VA

### 1.2 Assessed Products

Five BWC were selected and acquired for the assessment based on market research and recommendations from the focus group.<sup>1</sup> Product selection criteria identified specifications, attributes, or characteristics a product should possess to be considered for the assessment.





<sup>1</sup> The Kustom Signals Eyewitness Vantage was identified as a product to be assessed. However, the company brought a new product to the event that was not commercially available at time of assessment. Evaluators had an opportunity to use the product, but results are not presented in the report because it does not meet the SAVER program’s requirement of commercial availability.

The assessment team established the following product requirements when determining the scope of product types for the assessment:

- Products must be commercially available at time of assessment
- BWC must be capable of automatic activation via remote sensors<sup>2</sup>

Based on market research and the focus group’s recommendations, four products from three vendors were considered for the assessment. The products selected for assessment and their key specifications are shown in Table 1-2.

**Table 1-2 Assessed Products’ Key Specifications**

Product	Dimensions (h x w x d) (inches)	Field of View (degrees)	Battery Runtime (hours)	Pre-Event Buffer (sec)	Video Frame Rate (fps)	Holster Activation	Vehicle Activation	Other Activation Available
 Axon Enterprises Body 3	3.8 x 2.6 x 1.2	125 hor. 69 vert. 146 diag.	12+	30-120	30	✓	✓	✓
 Motorola V300	3.5 x 2.7 x 1.0	130 hor. 73 vert.	12	15-120	5/10/ 15/30	✓	✓	✓
 Motorola VB400	3.5 x 2.7 x 1.0	120 hor. 65 vert. 140 diag.	12	120	25/30			✓
 Utility Associates BodyWorn (EOS)*	6.2 x 3.0 x 0.3	90-140	12	0-120	30	✓	✓	✓

*Notes: The specifications in this table represent the equipment as assessed  
\* At time of assessment the product was known as BodyWorn. Utility has since renamed the product line “EOS.”*

<sup>2</sup> The Motorola VB400 features proximity activation and keyword activation, but not holster or vehicle activation. Changes were made to the assessment activities at the evaluators’ discretion to allow assessment of these features using the provided activity areas.



## 2.0 EVALUATION CRITERIA

The SAVER focus group identified 31 evaluation criteria and assigned each criterion to one of the five established SAVER assessment categories described below:

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

The focus group participants assigned weights, indicating the level of importance of each evaluation criterion and the five SAVER assessment categories. Evaluation criteria were weighted on a 1 to 5 numerical scale, with 1 indicating that an evaluation criterion is of minor importance and a 5 indicating that an evaluation criterion is of utmost importance. Some criteria were designated “information only.” As relevant product specifications, these criteria (e.g., price, warranty information) are included in this report, however, they were not weighted nor scored.

The SAVER assessment categories were then assigned a percentage to represent each category’s importance relative to the other categories. Table 2-1 presents the evaluation criteria and their associated weights as well as the percentages assigned to the SAVER categories. Evaluation criteria as defined through the focus group process are defined in Appendix A.



Table 2-1 Evaluation Criteria

SAVER CATEGORIES				
Capability	Usability	Deployability	Maintainability	Affordability <sup>3</sup>
Overall Weight 40%	Overall Weight 20%	Overall Weight 20%	Overall Weight 15%	Overall Weight 5%
Evaluation Criteria				
Battery Life*† Weight: 5	Ease of use of Controls† Weight: 5	Mounting Options† Weight: 4	IT Support* Weight:5	Warranty* Weight: 4
CAD System Integration* Weight: 5	Field Tagging Weight:4	Size† Weight: 3	In-house Maintenance* Weight: 4	Training Costs* Weight: 3
Pre-Event Buffer Weight: 5	Customizability of Triggers Weight: 4	Weight† Weight: 3	Charging Method* Weight: 4	Vendor Storage Flexibility* Weight: 3
Overall Durability† Weight: 5	DEMS Integration* Weight: 4	User Assignment*† Weight: 3	Training Services* Weight: 3	
Integration with Court System Evidence Requirements* Weight: 4	Classification Error Rate Weight: 4			
Cellular Connectivity* Weight: 4	Ability to Use while Wearing Gloves† Weight: 2			
Audio Quality Weight: 4				
Image Quality Weight: 4				

<sup>3</sup> Pricing is available upon request from individual manufacturers.



<b>Remote Triggers†</b> Weight: 4				
<b>IP Rating*†</b> Weight: 3				
<b>Image Stabilization</b> Weight: 3				
<b>Operable Temperature Range*†</b> Weight: 3				
<b>Motion Blur Mitigation</b> Weight: 3				
<b>Privacy Controls</b> Weight: 2				
<i>Notes</i> * Indicates assessed by specification † Indicates criteria that will be assessed for both the camera and sensor				

### 3.0 ASSESSMENT METHODOLOGY

Products were assessed in two phases: (1) specification assessment and (2) operational assessment. Throughout the assessment, evaluators worked in teams of three. Two data collectors observed each team of evaluators as they completed the assessment activities.

Focus group participants previously provided recommendations on which criteria should be evaluated with a specification assessment or an operational assessment. In some cases, criteria may be evaluated by both, and, in some cases, criteria are not assessed, but relevant information is included in the assessment report.

#### 3.1 Phase 1: Specification Assessment

During the specification assessment, vendor representatives presented to evaluators, familiarizing them with each product’s proper use, capabilities, and features. Evaluators were also given the reference materials included with each product when purchased. Evaluators assessed each product based on manufacturer-provided information and specifications prior to the assessment.

Evaluation criteria assessed during this phase included the following:

Evaluation Criteria Assessed
CAD Integration
Integration with Court System Evidence Requirements
Operable Temperature Range
IP Rating
DEMS Compatibility
Vendor Storage Flexibility
Warranty
Training Costs
In-house Maintenance
Training Services
Battery Life
Cellular Connectivity
Charging Method
User Assignment
IT Support



Figure 3-1 Familiarization sessions of Axon (top), Motorola (center) and Utility (Bottom)



### 3.2 Operational Assessment

Evaluators then assessed each BWC along with automatic activation sensors based on their hands-on experience with the products in three operational scenarios:

- 1) Emergency Light and Proximity Automatic Activation
- 2) Unholstering Firearm Automatic Activation and Visual Acuity
- 3) Mock Room Clearing

#### 3.2.1 Emergency Light and Proximity Automatic Activation

On a roadway outside the SPTC’s shoot house, evaluator teams donned their body-worn camera on their standard uniform shirt. A vehicle equipped with emergency lights and the respective demonstration kit for auto-activation trigger being tested was parked outside. With their body-worn cameras turned on but not yet recording, a pair of evaluators were notified of a disabled vehicle. The evaluator pair, seated in the sensor-equipped vehicle, turned on the emergency lights and sensor demonstration kit, drove to the scene, unbuckled their seatbelts, stepped out of the car and conducted a scripted field interview of the occupants of the mock disabled vehicle. Driving a separate cruiser, a second evaluator pair arrived on scene, to test if their cameras automatically activated due to their proximity to the first evaluator’s camera. Once the scripted dialogue was completed, the evaluators returned to their cruisers and stopped their body-worn cameras. The scenario was then repeated with the evaluators switching roles. After the second iteration of the scenario was completed, the evaluators reviewed the camera footage to assess if the system performed according to the vendor’s specifications.

Evaluation Criteria Assessed
Pre-Event Buffer
Remote Triggers
Ease of Use of Controls
Field Tagging
Customizability of Triggers
Classification Error Rate



Figure 3-2 Emergency Light Activation Scenario

#### 3.2.2 Unholstering Firearm Automatic Activation and Visual Acuity

Inside the shoot house, evaluators donned body-worn cameras on their standard uniform shirts or within provided vests, and configured their holsters with activation sensors. Some evaluators donned gloves as well. Using non-functional training firearms (clearly marked as such) and the appropriate holsters with the activation sensors mounted, evaluators ensured their cameras were powered on, drew their firearms, and acquired targets as presented on posters throughout the shoot house. Unholstering (or drawing) their weapon should have activated the evaluators’ cameras to start recording. The evaluators said aloud what target each poster depicted for later comparison to video footage captured by the BWCs. Evaluators also performed functionality tests assessing privacy controls and mute buttons manually.





They announced their intent to activate a feature, activated via the buttons, counted out loud to five, and then disabled it the controls. The evaluators stopped the recording and moved to a new target station.

Evaluation Criteria Assessed
Audio Quality
Image Quality
Image Stabilization
Motion Blur Mitigation
Privacy Controls
Ease of Use of Controls



Figure 3-3 An evaluator with an unholstered mock weapon proceeds to a visual acuity chart.

### 3.2.3 Mock Room Clearing Scenario

In the shoot house, evaluators manually started their cameras' recording, then proceeded through a series of rooms, clearing the areas of staged potential threats. Rooms had varying degrees of lighting, based on window placement. Each room included silhouette targets, color charts and visual acuity signs. The evaluators used standard law enforcement room-clearing procedures and described the items they encountered aloud so that their voice record of what they were seeing could be compared later with the cameras' recordings. After clearing all of the rooms, evaluators stopped their cameras and tagged their video as to the nature and type of incident when possible.

Evaluation criteria assessed during this scenario included the following:

Evaluation Criteria Assessed
Overall Durability
Size
Weight
Mounting Options
Audio Quality
Image Quality
Image Stabilization
Motion Blur Mitigation
Ability to Use While Wearing Gloves
Field Tagging



Figure 3-4 Two evaluators with activated body worn cameras clear a room.





### 3.3 Data Gathering and Analysis

After each scenario, NUSTL data collectors used a questionnaire to record the evaluators' scores for each product according to the evaluation criteria listed in section 2.0. The questionnaire included specific questions for each criterion that the data collectors read to the evaluators. Evaluators then scored the criteria using the following 1 to 5 scale:

- 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 my expectations for this criterion.
- 5) The product exceeds my expectations for this criterion.

Once assessment activities were completed, evaluators had an opportunity to review their criteria ratings and comments for all products and to adjust them as necessary. Criteria that were rated multiple times throughout the assessment were assigned final averaged ratings by the evaluators. The overall averaged assessment and category scores were calculated for each product using the formulas in Appendix B.





Data collectors also captured evaluators' comments on advantages and disadvantages as well as general comments regarding the assessed products and on the assessment process. The evaluators' comments are summarized in this assessment report.

## 4.0 BODY WORN CAMERA RESULTS

Overall scores for the body worn cameras ranged from 3.3 to 4.1. Assessment results are presented in Table 4-1 and Table 4-2, while additional details and evaluator comments on each product are provided in sections 4.1 through 4.6.

Table 4-1 presents the overall assessment score and category scores for each BWC. Products are listed in order from highest to lowest overall score throughout this section. Calculation of the overall score uses the raw scores for each category, prior to rounding. Products with the same overall score are listed in order based on the raw data. Category definitions are provided in Appendix A.







Table 4-1 Assessment Results

Product	Overall Score	Overall	Capability	Deployability	Usability	Maintainability	Affordability
Axon Enterprises Body 3		4.1	4.1	4.2	4.0	4.2	3.8
Utility Body Worn		3.7	3.7	3.8	3.4	3.8	4.0
Motorola V300		3.6	3.1	3.9	3.9	4.0	4.0
Motorola VB400		3.3	3.1	3.8	2.9	3.9	3.6

Key: 1 (least favorable) to 5 (most favorable)

Table 4-2 presents the average evaluation criteria scores the products received from the evaluators for each evaluation criterion. A green, fully shaded circle represents the highest rating, while a red, unshaded circle represents the lowest rating.

Table 4-2 Evaluation Criteria Ratings

<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">                       (&lt;1.5)                 </div> <div style="text-align: center;">                       (1.5-2.5)                 </div> <div style="text-align: center;">                       (2.5-3.5)                 </div> <div style="text-align: center;">                       (3.5-4.5)                 </div> <div style="text-align: center;">                       (4.5-5)                 </div> </div> <div style="margin-left: 20px;"> <p><b>Key</b></p>  </div>		Products			
Category	Evaluation Criteria	Axon Enterprises Body 3	Utility Body Worn	Motorola V300	Motorola VB400
Capability	Battery Life				
	CAD System Integrations				
	Pre-Event Buffer				
	Overall Durability				
	Integration with Court System Evidence Requirements				
	Cellular Connectivity				
	Audio Quality				
	Image Quality				
	Remote Triggers				
	IP Rating				
	Image Stabilization				
	Operable Temperature Range				
	Motion Blur Mitigation				
	Privacy Controls				
Deployability	Mounting Options				
	Size				
	Weight				
	User Assignment				
Usability	Ease of Use Controls				
	Field Tagging				
	Customization of Triggers				
	DEMS Integration				
	Ability to Use While Wearing Gloves				

Maintainability	IT Support	●	●	●	●
	In-House Maintenance	●	●	●	●
	Charging Method	●	●	●	●
	Training Services	●	●	●	●
Affordability	Warranty	●	●	●	●
	Training Costs	●	●	●	●
	Vendor Storage Flexibility	●	●	●	●

\* These criteria were assessed by specification only.

## 4.1 Axon, Body 3

The Axon Body 3 camera features an F/2.0 fixed focus all-glass lens with a field of view (FOV) of 125.2° horizontal, 68.6° vertical, and 146.4° diagonal. The camera has a lux rating<sup>4</sup> that is better than 0.1 lux. The Body 3 is capable of recording at resolutions up to 1080p and has 64 gigabits (Gb) of onboard storage.

The camera does not have a video playback display. It does, however, have Bluetooth and Wi-Fi, which allows it to connect to the Axon View app (available for both Android and iOS devices) for video playback. Wi-Fi and cellular connections can be used to offload video evidence directly to base-station servers or to Axon cloud storage (via cellular link). The Body 3 has onboard 4G LTE connectivity to support real-time location sharing, evidence offloading, and livestreaming capabilities. The Axon Body 3 can be remotely activated via the Axon Signal Vehicle and Axon Signal Sidearm devices.

The Axon Body 3 received an overall assessment score of 4.1. Evaluator comments provided throughout the assessment are reported below, grouped by SAVER category. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group.

### 4.1.1 Capability

The Body 3 received a capability score of 4.1. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** Based on the specification provided by Axon, the approximately 12-hour battery life of the Body 3 met all of the evaluators' expectations. One evaluator stated that after two hours of on-and-off use, the battery was at 94%.
- **Overall Durability:** The Body 3 met all of the evaluator's expectations for durability. Some evaluators carried out the Emergency Light and Proximity Automatic Activation scenario in the rain, and one evaluator noted that the water appeared to roll off the camera.



Figure 4-1 Axon Body 3

Image Credit: Axon

<sup>4</sup> Lux is a unit of illuminance, however in camera specifications "lux rating" is used to describe the amount of light needed to produce an acceptable image. Acceptable image is not defined, so the rating is subjective and can't be used for direct comparison between manufacturers. It can be useful to get a general idea of low light performance.

- **Audio Quality:** All evaluators agreed that audio quality of the recorded videos met their expectations, emphasizing that upon review the clarity and fidelity of the audio was great. One evaluator did note some recordings had audio distortions in instances where multiple people were talking during the scenarios but that did not significantly degrade the quality.
- **Image Quality:** Evaluators agreed that the quality of the video recordings met all of their expectations. In support of this, an evaluator noted that the camera could clearly pick up things that they saw with their naked eye. However, another evaluator recounted that they could clearly see a visual acuity chart during a scenario but were unable to see the chart's visuals as clearly in the recording. Also, one evaluator noted that the video did not have a fisheye effect, which is a factor in the image quality.
- **Remote Triggers:** Axon offers the Signal Sidearm holster sensor and Signal Vehicle remote trigger sensor that are compatible with the Body 3. These remote triggers met all of the expectations of six evaluators. One such evaluator noted a positive feature of the Signal Sidearm was that the firearm had to be seated in order to reset the trigger and withdrawal the weapon in order to auto activate the camera. Three evaluators said the Axon remote triggers met most of their expectations, with two noting their concern that the holster sensors sensitivity to motion could lead to false activations.
- **Image Stabilization:** The ability of the Body 3 to resist movement and keep video footage stable as the camera was jostled met or exceeded the expectations of all evaluators. One evaluator noted that the mount kept the camera in place with minimal shakiness and the videos were stable and crisp even when it did move (shown in Figure 4-2).
- **Operable Temperature Range:** While the majority of evaluators agreed that the operable temperature range of the Body 3, which is  $-4^{\circ}\text{F}$  to  $122^{\circ}\text{F}$ , met all of their needs, two evaluators stated it met most of their expectations because they have at times needed to operate at temperatures below  $-4^{\circ}\text{F}$ .
- **Motion Blur Mitigation:** The motion blur mitigation feature of the Body 3 met or exceeded the expectations of all evaluators. After reviewing the recorded video, one evaluated stated the camera seemed to stay in focus even when they were purposefully moving to challenge this capability. Another evaluator noted that while they were moving in the secondary vehicle, their camera captured the license plate during the Emergency Light and Proximity Automatic Activation scenario without any blur.



Figure 4-2 Frame pulled from the Axon Body 3

#### 4.1.2 Deployability

The Body 3 received a deployability score of 4.2. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The various mounting options available to affix the Body 3 to the user met or exceeded the expectations of the evaluators. The evaluators felt that the number of mounts shown to them during the vendor presentation (which included pocket mounts, Z-brackets, magnetic mounts, modular lightweight load-carrying equipment (MOLLE) mounts,



Velcro pocket mounts, wing lock, etc.) were sufficient for their operations. Evaluators did not experience any issues with the camera chest mounts used during the assessment.

- **User Assignment:** The method to assign an individual user or a large group of users to a Body 3 camera, conducted through the device manager and evidence.com, met all expectations of eight evaluators and exceeded the expectations of one. Several evaluators noted the benefit of having multiple options for device assignment, including the ability to incorporate various identifiers (e.g., an officer’s badge ID or call number) and the potential to use near field communication for user assignment” However, one evaluator noted a radio frequency identification (RFID) check-out out feature would be ideal instead of having to log in to the management system to assign users.

### 4.1.3 Usability

The Body 3 received a usability score of 4.0. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use of Controls:** All the evaluators agreed that intuitiveness of using the Body 3 controls met all of their expectations. The evaluators emphasized that the simple and large event button on the front of the device, as shown in Figure 4-3, worked well with their PPE and the functionality of the event button (i.e., two clicks to turn on, one three-second long push to turn off) was very easy to use.
- **Field Tagging:** The field tagging capabilities of the Body 3 met or exceeded the expectations of all evaluators. One evaluator found it very easy to use the drop-down box in the mobile app to tag a video in the field. Another evaluator highlighted the auto tagging feature as useful in the field, saying it could otherwise be complicated to tag video while performing duties.
- **DEMS Integration:** The compatibility of the Body 3 camera and software with digital evidence management systems (DEMS) met the needs of all the of evaluators and their departments. According to the evaluators, Axon Evidence (commonly referred to as “evidence.com”) is a widely used DEMS by law enforcement agencies and its compatibility with the Body 3 provides a “plug and play” solution to uploading videos. Additionally, evidence.com maintains chain of custody and related evidentiary requirements for being admissible in court.



Figure 4-3 An evaluator prepares to activate the Body 3 via its event button.

### 4.1.4 Maintainability

The Body 3 received a maintainability score of 4.2. Specific evaluator feedback on evaluation criteria related to this SAVER category included:

- **IT Support:** The IT support Axon provides to users of the Body 3, as explained during the product familiarization session, exceeded three of the evaluators’ expectations and met all expectations of the other six. One evaluator highlighted the various options for contacting IT support (i.e., ticketing system, phone, e-mail and the Axon Investigate video investigation software). Collectively, evaluators appreciated that phone services and e-mail are monitored 24 hours a day, seven days a week.

### 4.1.5 Affordability

The Body 3 received an affordability score of 3.8. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Warranty:** Although the evaluators found Axon’s warranty for the Body 3 met most or all of their expectations, two evaluators took issue with the length of the included warranty. One evaluator stated that one year warranty for the camera was not long enough. Regardless of some participants’ concerns about warranty length, another evaluator valued Axon’s “no questions asked” policy for repair or replacement.
- **Vendor Storage Flexibility:** Axon explained that storage is scalable to account for policy changes with data retention; this met all expectations of the evaluators. One evaluator noted that the ability to maintain access to data even after discontinuing service with Axon was an important feature.

### 4.2 Utility, BodyWorn (EOS)<sup>5</sup>

The BodyWorn by Utility is a cell phone that features a 6.2-inch touch-screen display. The display is full color, allows for video playback, and works in both landscape and portrait orientation. The touchscreen is water-repellent and can be operated with a gloved hand. Utility also offers a wrist-mounted BlueTooth controller (Figure 4-4) for the camera’s. The BodyWorn can record at user-adjustable resolutions up to 1080p. Various lens attachments are available, providing fields of view that range from 90° to 140°. It has a lux rating of 0.1 lux. The BodyWorn records all video in a non-proprietary format, using the H.264/MPEG-4 Part 10 compression standard. In addition to video, the camera can capture still images.

The BodyWorn can connect to Bluetooth, Wi-Fi, LTE, 5G, Land Mobile Radio, and GPS. Through FirstNet and AT&T Band 14 connectivity, the camera can also connect to Utility’s interoperable in-car system. Utility intends for the camera to be able to offload video from the BWC to their cloud storage solution (AvailCloud) as soon as that becomes practical. The company offers a Wi-Fi hotspot (Smart Waypoints) with a built-in local storage cache to which users can upload video data from their body cameras. The Smart Waypoints device will then upload cached footage to the cloud as bandwidth permits.

The Utility BodyWorn received an overall assessment score of 3.7. Evaluator comments provided throughout the assessment are reported below, grouped by SAVER category. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group.



Figure 4-4 Utility’s BodyWorn (top) and its wrist-mounted controller (bottom)

Image Credit (top): Utility

<sup>5</sup> At time of assessment the product was known as BodyWorn. Utility has since renamed this product line “EOS”.

## 4.2.1 Capability

The BodyWorn received a capability score of 3.7. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** The battery life, 10.5 hours depending on usage and settings, met most or all of each evaluator's expectations.
- **Overall Durability:** The overall durability met most or all of the evaluator's expectations. Regarding mounts, one evaluator noted that there was no movement when the BodyWorn was locked into their vest, although another evaluator found the bracket not to be as sturdy as desired (see the mounting bracket in Figure 4-5.) One evaluator noted the pouch between the camera and the vest is larger than needed and poses the risk of the device falling to the floor if the camera became unintentionally dislodged.



Figure 4-5 The BodyWorn mounting bracket

- **Audio Quality:** The audio quality met most or all of the evaluators' expectations, however evaluators noted that they heard background noise, including static when moving through the scenarios. The microphones did not distinguish primary noise from ambient noise, though one evaluator noted this might be beneficial in some instances. Another evaluator noted that the other individuals in the car were recorded at lower volumes compared to the wearer of the camera when listening back to the audio.
- **Image Quality:** The camera's image quality met all of seven evaluators' expectations and most of two evaluators' expectations. One evaluator found it hard to make out some colors from a distance. Another evaluator was impressed by the video, observing that the camera focused easily and quickly to a target that the wearer ran toward. This same evaluator remarked that they could read more in the acuity signs with their naked eyes than in the signs as captured by the camera but also stated that their vision is not 20/20 and wondered if the video might match other responders' visions more closely.
- **IP Rating:** The IP52 rating of this product met all of two evaluators' expectations, met most of five evaluators' expectations, and met some of one evaluator's expectations. Because this product is a cell phone, it inherently is less rugged than the other form factors assessed. In particular, some evaluators were dissatisfied with its water resistance.



- Image Stabilization:** Seven evaluators found the BodyWorn met all of their expectations with regard to image stabilization, noting that the image adjusted quickly after motion was stopped (see Figure 4-6). Two evaluators found some of their expectations met. The mount kept the camera stable, though the evaluator from whose camera Figure 4-6 was taken was not sure if the image stability was due to the mount itself or stabilization features inside the camera. One evaluator stated that this feature was consistent with other assessed cameras, so nothing stood out to them about this feature.
- Motion Blur Mitigation:** The BodyWorn does not have motion blur mitigation, however, seven evaluators found it met most of their expectations for the criterion.
- Remote Triggers:** The remote triggers for this product met or exceeded all of evaluators' expectations. Evaluators noted that the BodyWorn sensors included a smart holster (Figure 4-7), officer down, lights and/or sirens, foot pursuit, and action zone (when an officer enters a predefined geographical zone) activation, a variety which exceeded their expectations. Some noted that it took significant effort to initially sync the holster sensor with BodyWorn. Once paired, it generally worked well, but did fail to activate the camera on one occasion during assessment activities.
- Privacy Controls:** Privacy controls on this BWC met all of seven evaluators' expectations and met most of them for two. One evaluator did not like that when using the watch-style controller, the mute function, along with other functions, became a two-handed operation. (This product has a default configuration of having to hold down a button in order to turn on the mute function).



Figure 4-6 Screenshot Image from the BodyWorn's footage



Figure 4-7 BodyWorn's Smart Holster sensor

## 4.2.2 Deployability

The BodyWorn received a deployability score of 3.8. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The BodyWorn must be used with Utility brand vests or retrofitted alternatives, due to the center mass mounting method of this camera (Figure 4-9). Evaluators found that this mounting option met most or some of their expectations. Overall, evaluators reported the mount felt secure but had limitations due to its fixed placement. One issue evaluators identified was when traveling in a vehicle, the seatbelt covers part or all of the camera lens as the camera being mounted at center mass. There is not an alternative placement option because the mount is incorporated into vests and uniform shirts. Due to the variety in body types across officers – in particular women officers – the center mass mount may also negatively impact the camera angle. For example, while a women evaluator was wearing the BodyWorn in a seated position in a vehicle, the camera’s angle resulted in video footage that differed from the wearer’s view (i.e., more of the upper windshield was captured than the scene in front of the vehicle). The vendor noted that the camera mounting position in the vest can be customized to agency requirements, such as moving to the side if the uniform includes a tie.
- **Size:** The size of this BWC met most of the evaluators’ expectations. The general consensus was that the camera is larger than expected; some even thought it was too large.



Figure 4-8 An evaluator places a BodyWorn camera into a Utility brand vest.

## 4.2.3 Usability

The BodyWorn received a usability score of 3.4. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use of Controls:** Six evaluators found the ease of using the controls met all of their expectations, while three indicated it met most. Evaluators expressed concern regarding the wrist-mounted controller’s battery syncing up with the camera, but most were able to connect it with ease. One evaluator noted that the addition of the wrist band style control turned some of the BodyWorn’s functions into a two-handed tasks, which complicated operations. Another evaluator commented they would have preferred fewer buttons on the wrist-mounted controller.



Figure 4-9 Evaluators paired the BodyWorn with the wrist-mounted Bluetooth controller.



However, one evaluator found value in having a controller separate from the device as the users otherwise need to remove the BWC from its vest mount to access its settings and functions.

- **Field Tagging:** Six evaluators found field tagging met all of their expectations and was user friendly. Three found the function met most of their expectations; one of these evaluators attributed this rating to needing to remove the camera from their vest in order to tag events in the video.

#### 4.2.4 Maintainability

The BodyWorn received a maintainability score of 3.8. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **In-house Maintenance:** Utility offers a subscription-based replacement program. Evaluators found the in-house maintenance options met most or all of their expectations. One evaluator noted that if anything went wrong with the camera, it would have to be sent back to the vendor for maintenance which is not ideal.
- **Charging Method:** The BodyWorn can be charged in-vehicle or via a wall charger. The charging methods met most or all of the evaluator's expectations. Evaluators noted that additional charging steps are needed because of the watch component. One evaluator was unsure if "docking" is an option for charging but noted it would be a welcomed option.
- **Training Services:** Training is included in the purchase package and Utility works with the department to plan training as the department sees fit. There is no cost and it can be done anytime. The training services offered by Utility met or exceeded the evaluators' expectations. Utility implements a train-the-trainer approach.

#### 4.2.5 Affordability

The BodyWorn received an affordability score of 4.0. A full warranty is offered through the life of the contract, training costs are included with purchase, and Utility's planned switch to a new DEMS platform will not require an additional fee. These features met all expectations of the evaluators.

### 4.3 Motorola, V300


The Motorola V300 is a body worn camera (see Figure 4-3) featuring a 1080p, scratch-proof, adjustable-lens camera with a built-in LCD display, dual microphones, 128 GB of memory, and a detachable, field-swappable battery. It has a field of view that is 130° horizontal and 73° vertical, which is adjustable 15° up and 20° down. The Motorola V300 measures 2.4 inches wide, 3.5 inches long, and 1.1 inches thick, and weighs 6.8 ounces.

The Motorola V300 can integrate with the Motorola APX radio's "man down" emergency trigger (activated when the radio is left horizontal for a configurable period of time), holster activation, and emergency light bar activation. The camera features pre-event buffering and "always on" Record-After-The-Fact buffering for up to 46 hours at 720p.



Figure 4-10 Motorola V300 mounted to a vest

Image Credit: Motorola




Motorola includes a one-year manufacturer warranty for both hardware and software. Extended warranties are offered from the second year through the fifth. A five-year contract with Motorola includes a device refresh and a warranty for the term of the contract.

The Motorola V300 received an overall assessment score of 3.6. Evaluator comments provided throughout the assessment are reported below, grouped by SAVER category. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group.

### 4.3.1 Capability

The Motorola V300 received a capability score of 3.1. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** The Motorola V300 has a 12-hour lithium polymer rechargeable battery that's field-swappable for extended shift work. Evaluators determined the battery life met all their expectations. One evaluator found the swappable battery to be a positive feature of the V300.
- **CAD System Integration:** The Motorola V300 cannot be activated remotely or turned on via computer-aided dispatch (CAD). However, Motorola can develop the necessary application program interface (API) to integrate the V300 with the agency's CAD system. When docked in a vehicle, the V300 body camera uploads to cloud-based or on-premises evidence management systems via wireless networks (e.g., LTE and FirstNet). The SmartControl mobile app allows users to review and tag videos, change camera settings, and view live video. Three evaluators found the V300 CAD system integration met all their expectations. The other six evaluators found the CAD system integration met most of their expectations.
- **Pre-event Buffer:** The Motorola V300's pre-event buffer is configurable from 0 seconds to 2 minutes. The Motorola V300 also features a configurable "always on" Record-After-the-Fact buffer that records continuously and can recover footage days later, even in the absence of manual or automatic camera activation. Evaluators found the pre-event buffer, the ability to customize the buffer length, and the Record-After-The-Fact capability met all of their expectations.
- **Overall Durability:** The Motorola V300 has an IP rating of IP67. Seven evaluators found the durability of the V300 met all their expectations and two evaluators found the V300 exceeded their expectations. These two evaluators did not expect the V300 to be very durable, but after dropping the V300 several times, they were impressed by its durability.
- **Integration with Court System Evidence Requirements:** The Motorola V300 uploads videos to Motorola VideoManager, which manages devices, ingests and stores video, shares video evidence, provides a verifiable chain of custody, and manages cases. Users can also tag videos in VideoManager. Video evidence can be transferred from VideoManager to Motorola's CommandCentral Evidence, if purchased separately, which provides DEM. Evidence can be stored on premises or on the cloud. All data is stored on Microsoft Azure, which is CJIS compliant. Five evaluators found the V300 court system evidence management system met all their expectations, one evaluator found the V300 met most of their expectations, and three evaluators did not score this category.
- **Cellular Connectivity:** The V300 has Bluetooth, Wi-Fi, and onboard GPS, but not cellular connectivity. The V300 can, however, upload videos via a dock linked to a Motorola in-car video system if the vehicle has LTE-cellular connectivity. Cellular connectivity of the V300 met some the expectations of three evaluators, and none of the expectations of six evaluators. While some evaluators did not see an absolute need for cellular connectivity, one evaluator commented that the V300 should have the option to install a SIM card.

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- **Audio Quality:** The V300 has two microphones that include foam baffles to block wind noise. All evaluators found the V300's audio quality met all their expectations. One evaluator remarked that they were able to hear all the voices in the background.
  - **Image Quality:** The V300 features a 130° horizontal and 73° (adjustable 15° up or 20° down) vertical FOV and can record at user-selectable resolutions up to 1080p. With 128 GB of onboard storage, the V300 can record up to 23 hours of footage at 1080p. The camera's 4k sensor is capable of recording in light levels as low as 0.035 lux. Six evaluators found the V300 met all their expectations for image quality. Three evaluators found the V300 met most of their expectations for image quality. One of these evaluators commented that their own vision had much better clarity than the V300 during testing, and the V300 footage seemed to be a bit hazy while inside. Another evaluator observed the V300 had slight trouble reacting to changing light conditions.
  - **Remote Triggers:** Automatic camera activation triggers for the V300 include the Yardarm Holster Aware sensor that initiates recording when a firearm or conducted-energy weapon is drawn, wireless activation when the emergency button on a Motorola APX portable radio is pressed, or bidirectional recording activation when a Motorola in-car video system is paired to the V300. In-car triggers include activation of lights, sirens, door locks, weapons locks, crash, speed, or other auxiliary 12-volt triggers. The V300 remote triggers met all the expectations of three evaluators, most of the expectations of four evaluators, and some of the expectations of two evaluators. One evaluator commented that there is an excessive amount of setup to connect multiple cameras to one car. Three evaluators – those who said the V300 met some of their expectations – commented that the need to pair cameras with the vehicle was a negative characteristic of the camera.
  - **Image Stabilization:** The Motorola V300 does not have image stabilization. The V300 exceeded all the expectations for image stabilization for three evaluators who felt the V300 video was good despite their jumping and rapid movements while wearing it. The V300 met all expectations for two evaluators, who did not notice any difference in the video compared to other cameras, despite the lack of image stabilization. The V300 met most or some of the expectations of four evaluators, who wanted the V300 to include image stabilization to help reduce blurring.
  - **Operable Temperature Range:** The V300 camera's operational and storage temperature range is -4°F to 140°F. Eight evaluators found this range met all their expectations. One evaluator said the V300 exceeded their expectations based on usability in cold weather environments.
  - **Motion Blur Mitigation:** The Motorola V300 does not have motion blur mitigation. The V300 met all the expectations of one evaluator, who commented that when paused, the video showed only minimal blurring. The V300 met most expectations for motion blur mitigation for eight evaluators. These evaluators commented that the video playback on the V300 blurred during frame-by-frame pauses; they wanted the V300 had included blur mitigation.
  - **Privacy Controls:** The V300 lacks an audio mute capability. The V300 met none of the expectations for six evaluators; three did not provide scores as the camera lacked mute or other privacy controls.

### 4.3.2 Deployability

The Motorola V300 received a deployability score of 3.9. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The V300 can be worn using various mounts (Figure 4-12), including a magnetic camera mount (left), MOLLE camera mount (left center), heavy-duty jacket magnetic mount (right center), or heavy-duty jacket clip (right). Seven of the evaluators found the V300's mounting options met all their expectations. Two evaluators, who wanted more mounting options, said the V300 met some of their expectations.



**Figure 4-11 Motorola V300 Mounting Options**  
*Image Credit: Motorola Solutions*

- **Weight:** Without mounting hardware, the Motorola V300 weighs 6.8 ounces. Seven of the evaluators found the weight met all their expectations. Two evaluators said the weight to met most of their expectations. One evaluator commented that the V300's weight was on the heavy side and speculated that it might be due to the removable battery. The other evaluator reported that the weight of the camera pulled on their uniform shirt, which inclined them to take the camera off when not in use.
- **User Assignment:** The V300 can be individually assigned to users or checked out from a kiosk via RFID assignment. All evaluators found the user assignment of the V300 met most or all their expectations.



### 4.3.3 Usability

The Motorola V300 received a usability score of 3.9. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use of Controls:** The V300 power button is on the bottom of the camera (shown in Figure 4-10). To shut the camera off, the user must press the power button, wait for the camera to prompt them to confirm powering off, and then press the power button again. The V300 has a function button on top and a side button that opens menus and scrolls through functions. Six evaluators found that the V300 controls met all their expectations, and for one evaluator, most of their expectations. That evaluator found the buttons used for field tagging confusing and struggled to understand which button to use to scroll and which controlled the functions. Two evaluators did not score use of controls for the Motorola V300. Evaluators appreciated the configurable buttons. They found it easy to tag videos using the buttons but struggled to see the LCD screen.
- **Field Tagging:** The V300 has a monochrome LCD to display status information but does not have a video screen. The user can connect to the Motorola SmartControl App, available on iOS or Android smartphones, to view and classify video content. Initial tagging can also be done on the device using the on-board LCD to select from a list of pre-programmed categories to apply to the most recently recorded video. The user can then update the tag from the SmartControl App or VideoManager. Six evaluators found field tagging for the V300 met all their expectations. Three evaluators said the V300 tagging to exceed their expectations. Overall evaluators found it easy to tag videos and appreciated having the ability to tag recordings on the camera itself. Three of these evaluators commented that it was difficult to set up and tag events on the V300, like a traffic stop for instance, from inside the Smart Control app.
- **Customizability of Triggers:** The user controls the V300 connection to the SmartControl app, vehicle WiFi base, APX radio and the holster sensor. Four evaluators found the V300 met all their expectations. Two evaluators remarked the V300 met most of their expectations. These evaluators found customization overly complicated. Three evaluators did not comment on the customizability of the V300 triggers.



Figure 4-12 Motorola V300 has its power button on the bottom of the BWC.

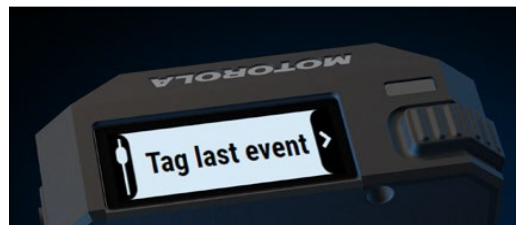



Figure 4-13 Motorola V300 has its power button on the bottom of the BWC.

Image Credit: Motorola Solutions



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- **DEMS Integration:** Recordings can be offloaded to agency storage at a station-based hardware dock, or a dock linked to a Motorola in-car video system if the vehicle has LTE-cellular connectivity. All video is uploaded to Motorola VideoManager, which manages devices, ingests and stores videos, allows videos to be viewed or shared, provides a verifiable chain of custody, and manages cases. Video evidence can be transferred to CommandCentral Evidence, if purchased, for digital evidence management. CommandCentral Evidence is Motorola’s unified evidence management solution that enables agencies to aggregate and organize all their digital content in one place. CommandCentral Evidence can be stored on premises or on the cloud and can produce audit trails and synchronized playback. It is CJIS compliant. Six of the evaluators found the V300’s DEMS integration met all their expectations. Three evaluators stated the V300 met most of their expectations for DEMS integration. These evaluators would have preferred DEMS integration to be a one-step process, not a transfer to VideoManager then to CommandCentral Evidence.

#### 4.3.4 Maintainability

The Motorola V300 received a maintainability score of 4.0. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **IT Support:** Standard Motorola technical support is available 24 hours a day, seven days a week via email, chat, and phone. All evaluators found that IT support met all their expectations. One evaluator appreciated that Motorola offers a chat option.
- **Charging Method:** The Motorola V300 can be charged via USB docking base, Wi-Fi camera vehicle docking base or ethernet eight-bay transfer station. All the evaluators found the V300 charging methods met all their expectations.
- **Training Services:** Motorola offers online training through virtual instructor-led training, on-site training, and train-the-trainer courses. All the evaluators found the training services to meet all their expectations.

#### 4.3.5 Affordability

The Motorola V300 received an affordability score of 4.0. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Vendor Storage Flexibility:** Motorola offers various storage solutions, including on-premises, cloud services, or a hybrid of on-premises and cloud storage. Motorola offers video as a service for \$49 per camera, which includes CommandCentral,<sup>6</sup> cloud storage hosted on Microsoft Azure, and unlimited BWC footage storage, plus 50 GB of external data storage per device. Eight evaluators found the V300 met all their expectations for vendor storage flexibility, while one evaluator said it met most of their expectations.

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<sup>6</sup> Motorola’s CommandCentral is a software platform designed to manage public safety operations, by integrating multiple sources of data (such as CAD systems, record management systems, video surveillance, and body camera footage) and communications. CommandCentral also allows real-time tracking of personnel and assets.

## 4.4 Motorola, VB400

The Motorola VB400 body camera features a wide angle 1080p HD video camera, dual microphones, five configurable buttons, a 12-hour integral battery, a customizable pre-event and post-event buffer up to 120 seconds, and 64 GB of memory. Without the mounting hardware, the Motorola VB400 measures 2.7 inches wide, 3.5 inches tall, 1.04 inches thick and weighs 5.7 ounces. The VB400 has an ingress protection rating of IP67 and is drop and shock tested to MIL-STD-810G. The VB400 has an operational temperature range from  $-4^{\circ}\text{F}$  to  $122^{\circ}\text{F}$  and can be charged between  $32^{\circ}\text{F}$  and  $77^{\circ}\text{F}$ . The VB400 can be automatically triggered by Peer Assisted Activation. The Motorola VB400 comes with a one-year manufacturer warranty on all hardware that is extendable for up to four years.



Figure 4-14 Motorola VB400

*Image Credit: Motorola*

The Motorola VB400 received an overall assessment score of 3.3.

Evaluator comments provided throughout the assessment are reported below, grouped by SAVER category. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group.

### 4.4.1 Capability

The Motorola VB400 received a capability score of 3.1. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** The battery in the VB400 is a non-removable, rechargeable lithium polymer battery with an estimated 12-hour run time. All the evaluators found the Motorola VB400's battery life met all their expectations.
- **CAD System Integration:** The Motorola VB400 cannot be activated remotely or turned on via CAD and CAD auto-tagging is not available. However, Motorola will develop the necessary API to integrate the VB400 with the agency's CAD system. Three evaluators found the VB400 met all their CAD system integration expectations. Two evaluators stated the VB400 met most of their expectations and commented that API integration can be challenging to implement. Four evaluators said the VB400 met some of their expectations since CAD auto-tagging on the camera is not available.
- **Pre-Event Buffer:** The Motorola VB400 features customizable pre-event and post-event buffers that can be adjusted in 30-second increments from 0 to 120 seconds. All the evaluators found the Motorola VB400's pre-event buffer met all their expectations.
- **Integration with Court System Evidence Requirements:** The Motorola VB400 uploads videos to Motorola VideoManager, which manages devices, ingests and stores videos, allows videos to be played and shared, provides a verifiable chain of custody, and manages cases. All video tagging is done in VideoManager. Video evidence can be transferred from VideoManager to Motorola's CommandCentral Evidence, if purchased separately, which provides DEM. Evidence can be stored on premises or on the cloud. All cloud data is stored on Microsoft Azure, which is CJIS complaint. All the evaluators found the VB400's integration with court system evidence requirements met all their expectations. One evaluator noted that CommandCentral Evidence uses CSV files, rather than PDF files, which evaluator finds more user friendly.

- **Cellular Connectivity:** While the VB400 has Bluetooth and GPS (for location tracking), it does not have cellular connectivity. Cellular connectivity of the VB400 met none of the expectations of any the evaluators. Evaluators also noted that the VB400 does not have a mobile app or the ability to preview videos on scene.
- **Audio Quality:** The VB400 has dual microphones. Three evaluators found the audio quality of the camera met all their expectations. Five evaluators stated it met most of their expectations and one said it met some of their expectations. Some evaluators noted poor quality audio, the microphones' picking up the wind while recording outdoors, difficulty hearing nearby voices, a loud beeping at the start of recording, and static distortions anytime another audio source was introduced.
- **Image Quality:** The VB400 features a 120° horizontal, 65° vertical, and 140° diagonal FOV video camera designed to mimic the human eye that can record at user-selectable resolutions up to 1080p. The camera's sensor is capable of recording in light levels as low as 0.2 lux. Three evaluators found the VB400's image quality met all their expectations. One of these evaluators commented that the image quality was low while the video was buffering, which could be an issue for new users who are not aware that this buffered video is not representative of the recorded video quality. Three evaluators found the VB400 to met most of their expectations. These evaluators commented that lighting conditions affected the video, backlighting made the image seem hazy, and users could see more with the human eye than the camera captured in low-light conditions. Three evaluators said the VB400 met some of their expectations. These evaluators commented that the image quality was poor and blurry, and that the targets and the visual acuity charts on the recorded video were not clear.
- **Remote Triggers:** Originally designed for security applications, the VB400 does not integrate with in-car camera systems or weapon unholstering activation. The VB400 has Peer Assisted Activation that triggers a camera to start recording when other VB400s are activated within a user-configurable radius of an activated camera. Five evaluators found the VB400 met most of their expectations and four evaluators, some of their expectations. Evaluators appreciated the VB400's Peer Assisted Activation but wanted more options for automatic activation.
- **Image Stabilization:** The VB400 does not have image stabilization. Four evaluators found the VB400's image stabilization met some of their expectation and five evaluators, none of their expectations. Evaluators commented that there was no stability from one frame to the next and no fluidity in the recorded video of the VB400 (as show in Figure 4-14).
- **Motion Blur Mitigation:** The VB400 does not have blur mitigation. All the evaluators found the VB400 met none of their expectations for motion blur mitigation. The evaluators commented that whenever the camera moved, there was a blur. One evaluator commented that the blur in the image produced an inaccurate representation of the actual scene.
- **Privacy Controls:** The VB400 can be configured to have a mute button. Seven evaluators found the privacy controls of the VB400 met all their expectations. One evaluator rated the VB400 as exceeding his expectations, noting that the mute button activated immediately. One evaluator stated the privacy controls met most of his expectations.



Figure 4-15 Video frame from the Motorola V400 BWC during the room clearing scenario



## 4.4.2 Deployability

The Motorola VB400 received a deployability score of 3.8. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The VB400 features several mounting options including a magnetic mount, a MOLLE mount, a quick release mount, a harness mount and an alligator-clip mount. Six evaluators found the mounting options for the VB400 met all of their expectations. One evaluator stated the mounting options for the VB400 met most of their expectations and two evaluators, some of their expectations. One of these two evaluators commented that there are so many different uniform configurations and the VB400 needs more mounts for specific applications.
- **User Assignment:** The VB400 can be individually assigned to users or checked out from a kiosk via RFID assignment. Checkout options are configurable. All the evaluators found the user assignment of the VB400 to meet most or all their expectations.

## 4.4.3 Usability

The Motorola VB400 received a usability score of 2.9. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use of Controls:** The VB400 has five software-configurable switches: a top switch, two small front switches, a large central switch and a side-mounted slide switch (see Figure 4-15). Two evaluators found the VB400's controls met all their expectations. Seven evaluators said the VB400 met most of their expectations. These evaluators commented that the buttons were small, can be difficult to manage, are unmarked (making it difficult to recognize their function), and are hard to find because they are flush with the camera.
- **Field Tagging:** VB400 does not have field tagging. Users must upload the videos and tag them within the software on a PC. One evaluator found the VB400 met most of their expectations and one evaluator, some of their expectations. These evaluators did not mind tagging footage after a shift rather than in the field. Seven evaluators found the VB400 to met none of their expectations for field tagging videos. One evaluator commented that there might be some confusion when there are multiple incidents recorded prior to the videos being uploaded and tagged, since that must be done after the fact via software.
- **Customizability of Triggers:** The VB400 has configurable Peer-Assisted automatic activation, in which an activated VB400 will activate other VB400 cameras within a pre-determined radius (30 foot maximum). Peer-Assisted activation can be configured to activate all of an agency's VB400 body-worn cameras within a set radius or a pre-defined group of cameras as configured in VideoManager. Based solely on being able to customize Peer Assisted activation, five evaluators found the VB400 met all of their expectations and two evaluators said it met most of their expectations. Two evaluators stated the customizability of triggers met none of their expectations.

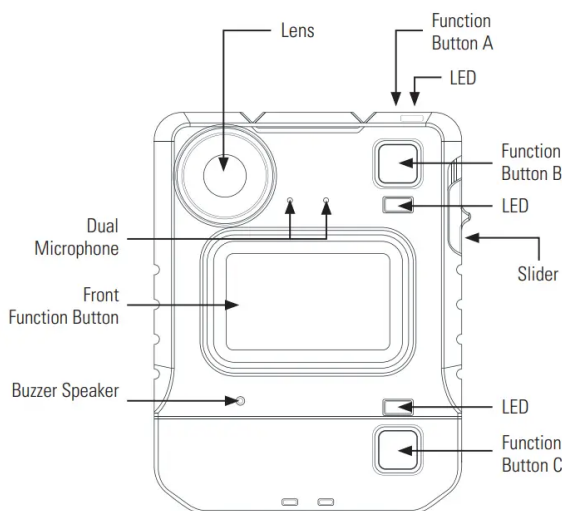



Figure 4-16 Motorola VB400 Layout

Image Credit: Motorola

- 
- **DEMS Integration:** As soon as a VB400 is docked, footage stored on it is automatically transferred securely to VideoManager, which manages devices, ingests and stores videos, allows users to view and share videos, provides a verifiable chain of custody, and manages cases. Video evidence is transferred to CommandCentral Evidence, if purchased separately, for DEM. CommandCentral Evidence is a unified evidence management solution that enables agencies to aggregate and organize all their digital content in one place. CommandCentral Evidence can be stored on premises or on the cloud and can produce audit trails, and synchronized playback. CommandCentral Evidence is CJIS compliant. Four of the evaluators found the VB400's DEMS Integration met all their expectations. Five evaluators found it met most of their expectations for DEMS Integration. These evaluators stated they would have preferred CommandCentral be included in the purchase of the camera and that DEMS Integration be a one-step process, not a transfer from VideoManager to CommandCentral.

#### 4.4.4 Maintainability

The Motorola VB400 received a maintainability score of 3.9. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **IT Support:** Standard Motorola technical support is available 24/7 via email, chat and phone. All the evaluators found the Motorola VB400's IT support met all of their expectations. One evaluator commented that they appreciated Motorola's offering a chat option.
- **Charging Method:** The Motorola VB400 can be charged via an in-car USB clasp (strictly for charging), solo port dock or 14-port dock. Six evaluators found the charging method of the Motorola VB400 met all of their expectations. Three evaluators stated the charging method met most of their expectations.
- **In-house Maintenance:** Motorola provides an in-person training on VB400 battery replacement so that it can be done in-house. All the evaluators found the VB400's in-house maintenance met all their expectations.
- **Training Services:** Motorola offers online training through virtual instructor-led training, on-site training, and train-the-trainer courses. All the evaluators found the training services to meet all their expectations.

#### 4.4.5 Affordability

The Motorola VB400 received an affordability score of 3.6. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Warranty:** Motorola provides an automatic one-year warranty on all VB400 hardware which is extendable for a total of four years. Six evaluators found the VB400 warranty met all their expectations, while three evaluators found it met most of their expectations. These three evaluators wanted a longer initial warranty.
- **Vendor Storage Flexibility:** The Motorola VB400 uses a video as a service model that costs \$29.99 per camera for 500GB per device. Video is stored on the cloud and hosted on Microsoft Azure Government. Extra storage costs are \$0.03 per GB. This cost does not include CommandCentral DEMS. CommandCentral can be added for an additional cost of \$29 per camera per month. Two evaluators found the vendor storage flexibility of the Motorola VB400 met most of their expectations. These evaluators would have preferred unlimited storage. Six evaluators found the vendor storage flexibility of the Motorola VB400 met some of their expectations. These evaluators commented that issues could arise when storage costs and retention policies are tied to budgetary planning.


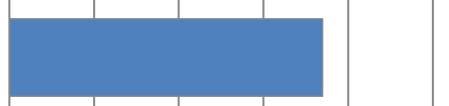
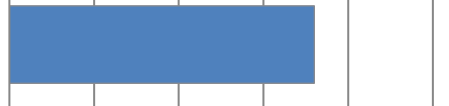


## 5.0 HOLSTER SENSOR RESULTS

Overall scores for holster sensors ranged from 3.8 to 3.6. The assessment results are presented in Table 5-1 and Table 5-2, while additional details and evaluator comments on each product are provided in sections 5.1 through 5.3. The Motorola V400 was unable to be paired with a holster sensor.

Table 5-1 presents the overall assessment score and category scores for each holster sensor. Products are listed in order from highest to lowest overall score throughout this section and in the tables below. Calculation of the overall score uses the raw scores for each category, prior to rounding. Category definitions are provided in Appendix A.










Table 5-1 Holster Sensor Assessment Results

Product	Overall Score	Overall	Capability	Usability	Deployability
Axon Enterprises Signal Sidearm		3.8	3.7	4.0	3.9
Motorola, Yardarm Holster Aware		3.7	4.0	3.6	3.6
Utility Smart Holster Sensor		3.6	3.4	4.2	3.6

Key: 1 (least favorable) to 5 (most favorable)

Table 5-2 presents the average evaluation criteria scores the products received from the evaluators for each evaluation criterion. A green, fully shaded circle represents the highest rating, while a red, unshaded circle represents the lowest rating.

Table 5-2 Evaluation Criteria Ratings

Key		Products		
				
(<1.5)	(1.5-2.5)	(2.5-3.5)	(3.5-4.5)	(4.5-5)
Category	Evaluation Criteria	Axon Signal Sidearm	Motorola Yardarm Holster Aware	Utility Smart Holster Sensor
Capability	Battery Life*			
	Overall Durability			
	Remote Triggers			
Usability	Ease of Use Controls			
	Ability to Use While Wearing Gloves			
Deployability	Mounting Options			
	Size			
	Weight			
	User Assignment*			

\* These criteria were assessed by specification only.

## 5.1 Axon, Signal Sidearm

The Axon Signal Sidearm, which was paired with the Axon Body 3 during the assessment, received an overall assessment score of 3.8. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group. Evaluator comments provided throughout the assessment are also reported below, grouped by SAVER category.



Figure 5-1 Axon Signal Sidearm sensor

### 5.1.1 Capability

The Axon Signal Sidearm received a capability score of 3.7. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Overall Durability:** Six evaluators indicated that the Signal Sidearm met all of their expectations and three evaluators said it met most. One evaluator who said it met most of their expectations attributed this to the sensor's getting scuffed and scratched during normal operations and the mounting bracket seeming like it could easily be broken or snapped off of the holster.
- **Remote Triggers:** All evaluators indicated that the Signal Sidearm met either most or all of their expectations. The "most" ratings were attributed to instances where the camera did not automatically activate when the wearer's weapon was drawn. Evaluators then made adjustments, where applicable, to ensure the mock weapons were fully seated prior to unholstering, which seemed to eliminate the issue.

### 5.1.2 Usability

The Axon Signal Sidearm received a usability score of 4.0 Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ability to Use While Wearing Gloves:** Four evaluators operated the signal sidearm while wearing gloves, all of whom cited no issues and found the sensor met all of their expectations.

### 5.1.3 Deployability

The Axon Signal Sidearm received a deployability score of 3.9. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The Signal Sidearm sensor attaches to the holster via two adhesive mounts and one bracket. Evaluators gave mixed feedback on the mounting options for the Signal Sidearm. Six evaluators found it met all their expectations, while the remaining three said it met some or most of their expectations.
- **Size:** The majority of evaluators indicated that the Signal Sidearm met or exceeded their expectations regarding size, while three said it met most.

## 5.2 Yardarm Holster Aware

The Yardarm Holster Aware, which was paired with the Motorola V300 BWC during the assessment, received an overall assessment score of 3.7. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group. Evaluator comments provided throughout the assessment are also reported below, grouped by SAVER category.



Figure 5-2 Yardarm Holster Aware sensor affixed to the holster and on a desktop

### 5.2.1 Capability

The Yardarm Holster Aware, when paired with the Motorola V300 BWC, received a capability score of 4.0. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** The battery life of the sensor is expected to last approximately three weeks but requires an estimated eight hours to fully charge. Seven evaluators found the Yardarm Holster Aware met most of their expectations, while two indicated it met some, basing their rating on the amount of time it takes to charge. One evaluator noted they would prefer to replace the battery rather than having to recharge it.

### 5.2.2 Usability

The Yardarm Holster Aware, when paired with the Motorola V300 BWC, received a usability score of 3.6. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use of Controls:** Evaluators had mixed feedback on the Yardarm's ease of use spanning across exceeding, meeting all and meeting some of their expectations. The three who indicated most of their expectations were met attributed their ratings to difficulties they encountered during setup. The sensor had no distinct controls or buttons. This made it quick to activate and it did not require any further interaction – reasons that three evaluators deemed it exceeding their expectations.
- **Ability to Use While Wearing Gloves:** One evaluator operated the Yardarm Holster Aware while wearing gloves and found the sensor to meet all of their expectations citing no issues.

### 5.2.3 Deployability

The Yardarm Holster Aware, when paired with the Motorola V300 BWC, received a deployability score of 3.6. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** The sensors were affixed to the holster with a permanent adhesive. Evaluators noted that permanent installation would be a limiting factor for adoption. Areas of concern related to agencies' allowing officers to use their own holsters and officers' potential unwillingness to alter them. Permanent installation would hinder agencies' reissuing the technology to other officers when shifts change.
- **Size:** All evaluators found the size met or exceeded all of their expectations. Evaluators noted that due to the device's small size, it would not get in their way or impact operations.
- **User Assignment:** Evaluators had mixed feedback on the user assignment of the Yardarm Holster Aware sensor. Four evaluators found it met all of their expectations; one said most; two, some; and two, none. Those who scored it as meeting some or none of their expectations experienced issues during the assessment with pairing the sensor with the BWC via the docking station.



## 5.3 Utility, Smart Holster Sensor

The Utility Smart Holster sensor, paired with the Utility BodyWorn (EOS) during the assessment, received an overall assessment score of 3.6. In each category below, the criteria are listed according to their order of importance as assigned by the Body Cameras with Automatic Activation focus group. Evaluator comments provided throughout the assessment are also reported below, grouped by SAVER category.



Figure 5-3 Utility Smart Holster sensor affixed to the holster and laying on a desktop

### 5.3.1 Capability

The Utility Smart Holster sensor received a capability score of 3.4.

Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Battery Life:** All evaluators found the sensor met some or most of their expectations. These ratings were attributed to the Smart Holster sensor's using a micro USB charger, which was not preferred based on alternative, enhanced charging methods available.
- **Overall Durability:** All evaluators found the Smart Holster sensor meet most or all of their expectations for overall durability. Those who indicated "most," attributed their rating to the adhesive used to affix the sensor to the holster, as it was not seen as a material that would stand up over time and regular use.

### 5.3.2 Usability

The Utility Smart Holster sensor received a usability score of 4.2. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Ease of Use Controls:** All evaluators found the Smart Holster sensor met or exceeded all of their expectations. One evaluator, however, noted that pairing seemed difficult.
- **Ability to Use While Wearing Gloves:** Two evaluators operated the Smart Holster sensor while wearing gloves, both of whom had no issues and found it met all of their expectations.

### 5.3.3 Deployability

The Utility Smart Holster sensor received a deployability score of 3.6. Evaluator feedback on evaluation criteria related to this SAVER category included:

- **Mounting Options:** Eight evaluators found the sensor met most of their expectations, while one found it met some. All evaluators said their responses were influenced by their inability to securely mount the sensor (e.g., no bracket option). The use of adhesive for sensor placement in the holster was not only a concern for durability but was also perceived as a potential snag point which could hinder operations.
- **Size:** All evaluators found the Smart Holster sensor met or exceeded all of their expectations, attributing their ratings to its small, compact size.
- **User Assignment:** Evaluators had mixed feedback on the user assignment for the Smart Holster sensor. Three evaluators found it met all of their expectations, three, most and the remaining three, some. Those who indicated some of their expectations being met attributed that to their encountering issues pairing the sensor to the camera. One evaluator noted that in order to successfully pair the devices they needed to physically connect them one by one.

## 6.0 VEHICLE AND PROXIMITY SENSOR FEEDBACK

Axon, Motorola and Utility offer sensors for hardwiring into a vehicle that automatically activate a BWC when the wearer engages emergency lights and sirens. Evaluators were in favor of this activation methodology as it seamlessly integrates with their policing operations.

Classroom demonstration models were brought to the assessments to showcase capabilities and characteristics of vehicle sensors. Due to the inability to hardwire these sensors into the test vehicles at the assessment, data collectors solicited only qualitative feedback, which summarized in this section.

### 6.1 Axon, Signal Vehicle

The Axon Signal Vehicle demonstration sensor was paired with the Axon Body 3 during the assessment in order to assess its automatic activation and proximity sensors.

Generally, evaluators found the automatic activation functioned as expected. In two instances, Signal Vehicle took up to thirty seconds for an activation to occur, but this was attributable to operator error. Evaluators found its distance for activation, an estimated range of 15–30 feet and in one scenario more than 50 feet, acceptable for its intended purpose.

Two evaluators noted that they would have preferred a continual sensor activation when on-scene as the current model is appropriate for the initial law enforcement officers arriving, but it does not account for assisting officers that may arrive later on scene. Ideally everyone involved in a response would have their cameras automatically activated if another officer's BWC was on.

In two instances when one camera did not activate on proximity, that camera was powered off, then back on again, which seemed to address the issue.

The muting feature was successfully assessed during this scenario as well.

### 6.2 Motorola, V300 Vehicle Kit

The Motorola's V300 Vehicle Kit demonstration sensor was paired with the Motorola V300 to assess its automatic activation and proximity sensors.

Several evaluators noted issues with maintaining the pairing between the demonstration sensor and the cameras, which lead to several failed activation attempts during the emergency light sensor portion of the scenario. When cameras were less than 30 feet away from the demonstration sensor, the number of automatic activations increased. This was attributed to the range of the BlueTooth connection used for pairing the demonstration sensor to the cameras.

The signal between the cameras was strong and resulted in consistently successful proximity activations.



Figure 6-1 Axon Signal Vehicle demonstration sensor



Figure 6-2 Motorola V300 vehicle kit demonstration sensor



### 6.3 Utility, Vehicle Sensor

The Utility Vehicle Sensor demonstration unit was paired with Utility’s BodyWorn (EOS) to assess its automatic activation. Note Utility cameras did not offer proximity sensors.

Automatic activation functioned as expected. The vehicle sensor demonstration unit was paired with a specific camera so when turned on, only that one camera was automatically activated even if other cameras were also present.

Evaluators noted the importance of having the cameras of their fellow officers on-scene activate.



Figure 6-3 Utility vehicle sensor demonstration unit



Figure 6-6 Evaluators simulate a wellness check while assessing vehicle sensor activation with the Motorola V300.



Figure 6-4 Evaluators test proximity activation sensors of the Axon Body 3.



Figure 6-7 An evaluator conducts a wellness check while his Axon Body 3 camera is activated.





Figure 6-5 Evaluators wearing the Utility BodyWorn approach a simulated broken down vehicle.

## 7.0 SUMMARY

Tables 7-1 through 7-3 summarize advantages and disadvantages of each BWC as well as holster sensors and vehicle sensors as identified by the evaluators.

Individual responder agencies that intend to purchase these technologies should carefully research the capabilities and features of available cameras or sensors to identify the products best suited to their operational needs.

Table 7-1 Body-Worn Camera Advantages and Disadvantages

Manufacturer/Product	Advantages	Disadvantages
 <p>Axon Enterprises/Body 3</p>	<ul style="list-style-type: none"> <li>• Motion blur mitigation feature allowed the camera to remain focused when wearer was moving or running</li> <li>• Image stabilization features allowed camera to capture license plates without blur while wearer was in a moving vehicle</li> <li>• Crisp image quality</li> <li>• Simple manual activation (two clicks) and deactivation (one three-second push)</li> <li>• Ease of use to operate</li> </ul>	<ul style="list-style-type: none"> <li>• Operating temperate range of -4 to 122 °F may not be sufficient</li> </ul>
<p><b>Overall Score: 4.1</b></p>		
 <p>Utility/Body Worn</p>	<ul style="list-style-type: none"> <li>• Camera focused easily and quickly even when wearer was moving or running</li> <li>• Mounting bracket kept the camera stable</li> <li>• Image adjusted quickly after wearer's motion stopping</li> <li>• Field tagging could be done directly on the phone and was user-friendly</li> <li>• Camera and watch-style controller connected with ease</li> </ul>	<ul style="list-style-type: none"> <li>• Mounting concerns due to placement of camera in the corresponding vest that does not account for the variety in body types between officers – in particular women officers – and can negatively impact the camera angle</li> <li>• Unable to distinguish primary noise from ambient noise</li> <li>• No motion blur mitigation resulted in the illegible items in close proximity of the camera</li> <li>• Not water resistant</li> <li>• Functions (e.g., muting) on the wrist-mounted controller results in the need for a two-handed operation</li> </ul>
<p><b>Overall Score: 3.7</b></p>		










Manufacturer/Product	Advantages	Disadvantages
 <p data-bbox="282 823 472 852">Motorola/V300</p>	<ul data-bbox="651 348 1058 907" style="list-style-type: none"> <li>• Pre-event buffer is adjustable in 30-second increments from 0–120 seconds</li> <li>• Features a configurable “always on” Record-After-the-Fact buffer which records continuously and can recover footage days later, even in the absence of manual or automatic camera activation</li> <li>• Outfitted with a 12-hour lithium polymer rechargeable battery that is field-swappable</li> <li>• Equipped with two microphones, which include foam baffles to block wind</li> </ul>	<ul data-bbox="1091 485 1490 779" style="list-style-type: none"> <li>• No blur mitigation which resulted in blurring during frame-by-frame pauses during playback</li> <li>• Instances of impacted image quality (such as haziness while recording indoors) and inability to react to changing light conditions</li> </ul>
<p data-bbox="131 938 350 968"><b>Overall Score: 3.6</b></p>		
 <p data-bbox="261 1461 472 1491">Motorola/VB400</p>	<ul data-bbox="651 1077 1058 1539" style="list-style-type: none"> <li>• Pre-event buffer is adjustable in 30-second increments from 0 seconds to 120 seconds</li> <li>• Features five configurable switches</li> <li>• Multiple methods for charging: in-car USB clasp, solo port dock or 14-port dock</li> <li>• Numerous mounting options: magnetic, MOLLE, quick release, harness and alligator clip</li> </ul>	<ul data-bbox="1091 1094 1490 1524" style="list-style-type: none"> <li>• No blur mitigation could impact the representation of the scene in the footage</li> <li>• No image stabilization hindered the fluidity between frames</li> <li>• Buttons were unlabeled and difficult to locate by feel because of being set flush with the BWC</li> <li>• Unable to field tag videos from camera (software required)</li> </ul>
<p data-bbox="131 1568 350 1598"><b>Overall Score: 3.3</b></p>		

Table 7-2 Holster Sensor Advantages and Disadvantages

Manufacturer/Product	Advantages	Disadvantages
 <p>Axon Enterprises/Signal Sidearm</p>	<ul style="list-style-type: none"> <li>Gloved operations did not impact use</li> <li>Small size would not negatively impact operations</li> </ul>	<ul style="list-style-type: none"> <li>Mounting bracket durability concerns (breakage and scuffing anticipated)</li> <li>Automatic activation inconsistent unless mock weapon was fully seated in the holster</li> </ul>
<p><b>Overall Score: 3.8</b></p>		
 <p>Yardarm/Holster Aware</p>	<ul style="list-style-type: none"> <li>Expected battery life of three weeks</li> <li>Quick activation</li> <li>Gloved operations did not impact use</li> <li>Small size would not negatively impact operations</li> </ul>	<ul style="list-style-type: none"> <li>Battery requires an estimated eight hours to charge</li> <li>Challenges experienced connecting the sensor to the camera during set up via docking station</li> <li>Sensor affixes to the holster with a permanent adhesive</li> </ul>
<p><b>Overall Score: 3.7</b></p>		
 <p>Utility/Smart Holster Sensor</p>	<ul style="list-style-type: none"> <li>Gloved operations did not impact use</li> <li>Small size would not negatively impact operations</li> </ul>	<ul style="list-style-type: none"> <li>Charges via micro USB only</li> <li>No bracket option for sensor; sensor is affixed with adhesive, which raises durability and snag point concerns</li> <li>Pairing difficulties between sensor and camera</li> </ul>
<p><b>Overall Score: 3.6</b></p>		



## 8.0 ACKNOWLEDGEMENTS

NUSTL thanks the assessment evaluators for their valuable time and expertise. Their insights and recommendations will assist responder agencies making procurement decisions and guide the planning and execution of future SAVER projects. The lab also extends appreciation to the Cabarrus County Sheriff's Office (North Carolina), Fairfax County Police Department (Virginia), Gwinnett County Police Department (Georgia), Philadelphia Police Department (Pennsylvania), Stanislaus County Sheriff's Department (California), Tampa Police Department (Florida), Troy Police Department (New York), Tulsa Police Department (Oklahoma) and Vail Police Department (Colorado) for allowing the evaluators to participate in this SAVER assessment and to the New York State Department of Homeland Security and Emergency Services State Preparedness Training Center for hosting.



## 9.0 REFERENCES

- [1] "IP Ratings," International Electrotechnical Commission, 2021. [Online]. Available: <https://www.iec.ch/ip-ratings>.





## APPENDIX A. EVALUATION CRITERIA DEFINITIONS

### Capability

**Battery Life** refers to the amount of time the primary power source will power the system. Recharge time and swappable batteries may also be considered.

**CAD System Integration** refers to the ability of the BWC to automatically integrate metadata from a computer aided dispatch system into recorded files. This helps reduce manual tagging.

**Pre-Event Buffer** refers to the continuously running buffer that captures a period of time before a BWC starts recording. The ability to specify the length of this buffer, including disabling it will be considered.

**Overall Durability** refers to the BWC's ability to withstand day to day use in the field without breaking.

**Integration with Court System Evidence Requirements** refers to the BWC's ability to maintain chain of custody and related evidentiary requirements to be admissible in court.

**Cellular Connectivity** refers to the BWC's ability to connect to 4/5G cellular networks for live streaming, remote control, and related functions.

**Audio Quality** refers to the fidelity of the audio recording associated with the video. This includes ability to capture the voice of the officer as well as suspects they're interacting with.

**Image Quality** refers to the fidelity of the video recording. In particular parity between the camera and the human eye is desired, to convey what the officer using the BWC was seeing at the time of recording.

**Remote Triggers** refers to the ability of the BWC to be remotely activated by sensors.

**IP Rating** refers to the degree of water and dust resistance of the device as certified by the ingress protection standard.

**Image Stabilization** refers to the BWC's ability to resist movement and keep video footage from shaking as the camera is jostled.

**Operable Temperature Range** is how hot or cold it can be in the environment that the BWC is working in.

**Motion Blur Mitigation** refers to BWC's ability to resist blurring of moving objects in frame.

**Privacy Controls** refers to functions such as mute buttons that protect operator privacy.

### Usability

**Ease of use of Controls** refers to the intuitiveness of using the controls, and making adjustments including navigating through menus.

**Field Tagging** refers to the ability and difficulty of categorizing footage after it is taken.

**Customizability of Triggers** refers to the ability to change how the BWC reacts to each trigger.

**Digital Evidence Management System (DEMS) Integration** refers to the ability to offload footage into a DEMS.



**Classification Error Rate** refers to likelihood of the system to be accidentally triggered.

**Ability to Use while Wearing Gloves** refers to the compatibility of the system controls with gloved hands.

## **Deployability**

**Mounting options** refers to the ability for the BWC and sensor to be affixed to the user's body, holster or vehicle.

**Size** refers to the physical dimensions of the camera and sensor.

**Weight** is how heavy the device is.

**User Assignment** refers to how a user is associated with the BWC or sensor (scanning a badge, done via software, etc).

## **Maintainability**

**IT Support** refers to quality and availability of technical support from the manufacturer.

**In-House Maintenance** refers to the refers to the ability to fix problems at the user's site, rather than having to ship a BWC to the manufacturer.

**Charging Method** refers to the type of connector used to charge the device, and how likely it is to require repair.

**Training Services** refers to the recurring training that is required to maintain a BWC and its sensors.

## **Affordability**

**Warranty** refers to the terms, conditions, and cost of warranty service.

**Training Costs** refers to costs per person for training or train the trainer courses.

**Vendor Storage Flexibility** refers to the cost and availability of potential changes in retention (and therefore storage) requirements during the lifetime of a contract caused by changes in legal requirements.

## APPENDIX B. ASSESSMENT SCORING FORMULA

The overall assessment 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 criterion weight assigned by the focus group, thus resulting in a weighted criterion rating. 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

$$\frac{\sum(Average\ Criterion\ Rating \times Criterion\ Weight)}{\sum(Criterion\ Weights)} = \frac{Category\ Score}{Score}$$

### Category Score Example <sup>vii</sup>

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

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 Assessment Score Formula

$$\sum(Category\ Score \times Category\ Percentage) = Overall\ Assessment\ Score$$

### Overall Assessment Score Example

<u>Capability</u>	<u>Usability</u>	<u>Affordability</u>	<u>Maintainability</u>	<u>Deployability</u>	
(4.0 × 33%)	+	(4.2 × 27%)	+	(4.2 × 20%)	+
		(3.8 × 13%)	+	(4.5 × 7%)	=
					4.1

<sup>vii</sup> Examples are for illustration purposes only. Formulas vary depending on the number of criteria and categories assessed and the criteria and category weights.

## APPENDIX C. INGRESS PROTECTION LEVELS (IP CODE)

This section provides information on the levels of ingress protection as specified by the 2-digit designations in the IEC 60529 standard [9]. Table C-1 provides levels of solid ingress protection (first digit). Table C-2 provides levels of liquid ingress protection (second digit).

**Appendix Table C-1 Levels of Solid Ingress Protection per First Digit of IP Code**

Digit	Object Size Effective Against	General Description
0	No Protection	No protection against contact and ingress of solids
1	> 50 mm	Large surfaces, e.g., back of hand, but no protection against deliberate contact with body part
2	> 12.5 mm	Prevents entry of fingers and similarly sized objects
3	> 2.5 mm	Prevents entry of tools, thick wires, etc.
4	> 1 mm	Prevents entry of most wires, screws, large ants, etc.
5	Dust Protected	Dust ingress not entirely prevented but does not enter in sufficient quantity to interfere with satisfactory operation of equipment
6	Dust Tight	No ingress of dust

**Appendix Table C-2 Levels of Liquid Ingress Protection per Second Digit of IP Code**

Digit	Water Exposure Protection	General Description
0	No Protection	No protection
1	Vertically dripping water	Vertically dripping water has no harmful effects
2	Dripping water, enclosure tilted up to 15 degrees	Vertically dripping water has no harmful effects when enclosure is tilted at an angle up to 15 degrees of normal vertical position
3	Spraying water	Water sprayed at angles up to sixty degrees from the vertical position has no harmful effects
4	Splashing water	Water splashed against the enclosure from any direction has no harmful effect
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction has no harmful effects
6	Powerful water jets	Water projected in powerful jets against the enclosure from any direction has no harmful effects
7	Temporary immersion in water	Ingress of water in harmful quantity is not possible when the enclosure is temporarily immersed in water under standard conditions or pressure and time
8	Continuous immersion in water	The equipment is suitable for continuous immersion in water under conditions more severe than for numeral 7