

5 Year Total Cost of Ownership Analysis:



Typical Clip-On Body Cameras compared to
Utility BodyWorn™ Video Camera

May 2016

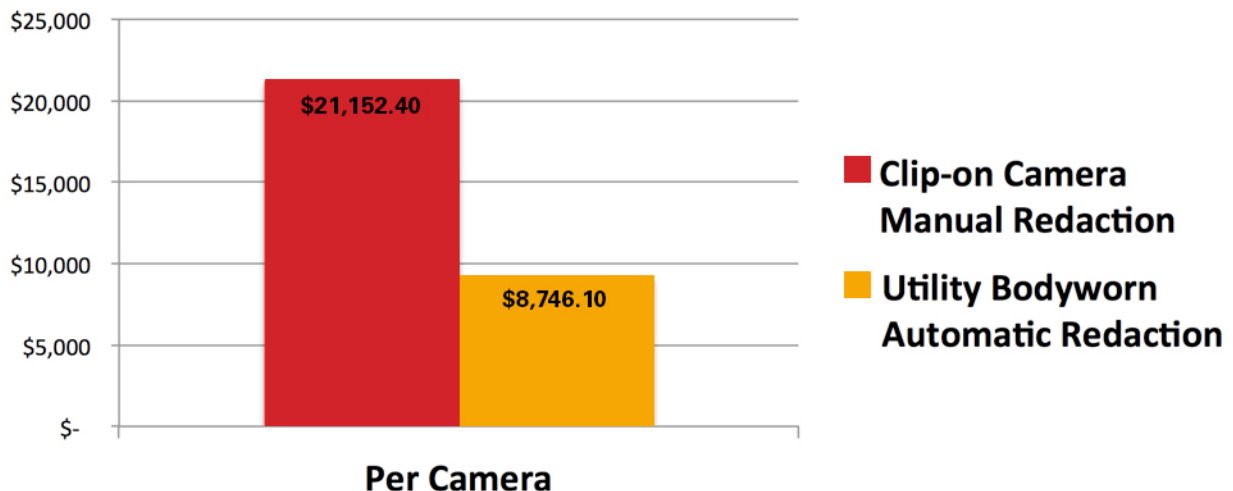
Executive Summary

Many Police Departments who have implemented body worn cameras (BWC) have been surprised to find significant additional costs. Body cameras are not simply purchased and used like a flashlight. IT support systems and staffing are required at significant additional cost to reliably store and manage video – often for years. Therefore Police Departments need to consider the Total Cost of Ownership (TCO) over 5 years. The BWC hardware itself is often far less than half the five (5) year TCO. This report provides (1) a methodology for calculating a TCO analysis, and (2) a TCO summary for two leading BWC alternatives.

Police Departments often neglect to consider the cost of Video Redaction in the BWC TCO. Redaction is obscuring faces and body parts with identifiable tattoos before video can be released for a FOIA or Press request, or before video can be shown in an open courtroom at a Trial. The staffing required to manually redact 1% of recorded video often costs more than the BWC purchase. However, a BWC with automatic video redaction software can typically avoid enough manual redaction labor hours each year to pay for the BWC.

Video storage, docking stations, training, hardware maintenance and repair, and additional software licenses for Court Officers, Prosecutors and Defense Attorneys also need to be considered in calculating a realistic TCO. Most vendors who provide cloud storage are moving to unlimited video storage as part of their total solution. Local video storage has to add the purchase cost, operations, cybersecurity, and disaster recovery staffing and support costs for local video storage servers as additional costs in their five (5) year TCO calculation.

A realistic TCO can vary dramatically as shown in the following chart.



This report shows the very compelling five (5) year TCO savings for a BWC solution that includes automatic video redaction and classification on the BWC.

Objective

The objective of this analysis is to provide (1) a framework for calculating the Total Cost of Ownership, and (2) document a per unit TCO comparison of Utility's BodyWorn™ video camera compared to a typical Clip-on manually operated body-worn video camera.

Background and TCO Cost Factors

The rise of BWC technology can be attributed to three primary goals: (1) Promote police accountability and transparency as a matter of public record (2) Improve high-quality public service provided by police officers, and (3) Increase the perceived legitimacy of officer-constituent interactions (Miller, Toliver and Police Executive Research Forum). Furthermore, law enforcement agencies expect BWC technology to advance proactive and preventative efforts to reduce crime (Police Executive Research Forum).

Several companies, including Utility, Inc. (Utility) have developed BWC devices that address the goals stated above. Each device addresses these goals with different types of device functionality, real-time connectivity, need for additional peripherals, and video management software capabilities. For the purpose of this analysis, commonly deployed body-worn cameras and Utility's Generation-2 BodyWorn devices are compared.

Cost is a key factor for whether a law enforcement agency will implement BWCs. However, too often Police departments fail to consider all costs that should be included in the Total Cost of Ownership (TCO) analysis. Police Departments have found TCO to be a major budget problem as hidden additional costs emerge after deployment. Costs often not fully considered during a vendor selection process include:

- Data storage – either internet cloud storage or local server video storage
- Video Management software – how to Classify, Search, Play, Export, and Purge video
- Network Infrastructure to upload video from each BWC to central video storage
- Power and Security for docking stations for BWC systems that require docking stations
- Video Redaction costs – for responding to Freedom of Information Act (FOIA), Press, and Courtroom playback of BWC videos where the privacy of bystanders, minors, victims, and police officers has to be protected
- Officer time spent classifying video – and therefore not on patrol
- Accidental deletion of un-classified video
- New officer and staff training for BWC operation and recording policy
- Re-training police officers and staff about recording policy changes

In her recent article, "Cloud Storage for Camera Data?" Julie Anderson, head of AG Strategy Group, highlighted the massive amount of data produced by video recordings. The Seattle Police Department has produced 360 terabytes of data from police car dash cams. As Police Departments also deploy BWCs on every officer, this will add an additional huge amount of

video data that has to be stored, secured, managed, and eventually deleted. The Anderson article cites the case of Duluth, Minnesota, where the police department spent \$5,000 to purchase Body Cameras, but then struggled to support the \$78,000 storage cost over a two-year period (Anderson). In another example, Minooka, Illinois recently discontinued using body-worn video cameras because the administrative burden of responding to requests for videos from attorneys and the Courts became overwhelming.

Most body-worn camera solutions include Video Management software that manages the storage, search, playback, security and retention of BWC video. Often overlooked is that stakeholders outside of the Police Department such as Court officers, Prosecutors, and Defense Attorneys also need access to BWC video. In the past video from In-Car Video systems was made available by burning and mailing CD and DVD disks of a video, which is a significant administrative burden for the Police Department. Both the Press and private citizens can often submit Freedom of Information Act (FOIA) requests for a video. This administrative burden will only increase dramatically once every officer is wearing a BWC and recording 2 hours or so of video per shift. Some BWC Video Management systems can be configured to allow stakeholders such as Courts and Prosecutors to have access to BWC Video, but often at an additional cost for software user licenses. These BWC video distribution administrative costs have to be considered in a full five (5) year TCO analysis.

BWC video typically requires redacting (fuzzing out faces and skin) before a video can be released in response to Court, Press, and Citizen FOIA requests. Video must protect the privacy of both police officers and the public, as third parties such as gang members sitting in a Jury gallery may also see the video. 30 frames per second x 60 seconds in a minute x 60 minutes in an hour totals 108,000 video frames in an hour of video. Manually redacting 108,000 video frames in an hour of video is generally a tedious and error prone process that can often take 8+ hours of staff time to redact a one-hour video. The additional staffing required to redact video can be huge. Video redaction is often the largest cost component of the five (5) year TCO for a BWC, yet is often overlooked as police departments consider BWC alternatives.

Once BWCs are deployed, video needs to be classified so that it can be found during video searches, and then purged according to a department's video retention policies. Some videos such as felonies and DUI need to be retained for years, while most other videos can be purged after the minimum retention time according to retention policy. Classifying a video is critical to avoiding the example of Fountain CO Police, where 15,000 unclassified videos that included some felony video were accidentally purged and lost forever. Being able to classify video on the BWC at an Incident scene takes very little effort. On the other hand, if a police officer has to dock a BWC at the end of a shift, upload the video, and only then is able to use a Video Management system to remember and classify video (as was the case in Fountain CO), then the classification labor effort is significantly higher, accuracy suffers, and often video never gets classified. Video classification effort is a significant part of the five (5) year TCO for a BWC, and also a primary factor for reliably storing and retaining BWC video.

A number of police departments have found they also need to spend millions of unbudgeted dollars on networking infrastructure and power expansion to support docking stations to upload videos. All officers at the end of a shift docking their BWC and uploading video overwhelmed the data communications network at the Dallas TX Police department, to the point where no Dallas city employee could send or receive email. Charlotte-Mecklenburg Police spent over \$1M in data network and power upgrades needed for BWC docking stations. These networking and power upgrade costs have to be included in the five (5) year TCO.

The security of uploading video can be compromised if a prisoner trustee is mopping floors in a non-secured room or hallway where BWC docking stations are installed. At least one BWC docking station can be rebooted at any time with a paper clip. A BWC removed from a docking station prior to upload may never upload the video to secure storage. The cost of security over docking stations is another component of five (5) year TCO that is often overlooked.

Finally, soft costs are often not included in the TCO. When deploying BWCs, officers need training to learn how to operate their new device and how to apply the department's body-worn video recording policies. Furthermore, if recording policy changes, all officers using a manually controlled BWC will need to be re-trained in how to apply the new recording policy. Recording policy change training might take months to schedule and complete. During the retraining effort, video recording policy will be applied inconsistently depending upon whether an officer has been retrained yet. Police department new hires also have to be trained. The cost of both trainer and officer class attendee time for initial deployment, plus on-going training after deployment, must be included in the five (5) year TCO.

Total Cost of Ownership Methodology

The TCO in this analysis was calculated for a 100-unit BWC deployment. This size department is thought to have the economies of scale to be representative for all 100+ officer Police departments on a per unit basis. This per BWC unit cost can therefore be applied to estimate the TCO for any 100+ unit Police Department.

In this comparison, the typical BWC and Utility are compared on the basis of three cost categories: deployment costs, direct ongoing costs, and indirect costs. Device, peripheral, storage, and software costs were aggregated from cited data sources, and represent manufactured suggested retail prices (MSRP). Redaction cost is based on effort and costs for manual and automatic video redaction as cited in Police Department RFPs, published news sources, and vendor demonstrations. Soft costs were estimated using data from Glassdoor.com salary estimates and other cited news and data sources.

Deployment Costs

Deployment costs are the costs most commonly associated with purchasing BWCs. These costs include the device cost as well as the cost of any peripheral devices and training for the devices. For this comparison, deployment costs are broken down into five subcategories:

1. **BWC Hardware Cost:** This is the cost of the actual body camera device. The MSRP is provided in this subcategory.
2. **Docking Station Cost:** This is the cost of any charging or data offload stations required to be purchased alongside the BWC. This cost does not include any installation, cabling, or security for Docking Station location. The MSRP is provided in this subcategory.
3. **Policy-Based Automatic Recording:** This is the cost of additional peripheral devices or software required to implement automated policy-based recording such as automatic recording triggers from police car light bars, doors, and other peripheral inputs and sensors. This cost does not evaluate how the solution operates or attempt to qualify the costs or efficacy of any limitations or concerns associated with the solution. The MSRP is provided in this subcategory.
4. **In-Field Video Review Device:** This is the cost of peripheral devices or software required to provide in-field video review, GPS location tagging, and other capabilities not provided by the BWC itself. Some BWC solutions claim capabilities that are only available through a secondary device that also has to be purchased and supported. This cost does not evaluate how the solution operates or any limitations or concerns associated with the solution. The MSRP is provided in this subcategory.
5. **Device Training:** This is the cost of training professional services provided by the vendor providing the BWC solution. This cost does not include the value of Police Officer time spent attending classes or peripheral material or location costs, which can be substantial. The MSRP for a 100-unit BWC deployment divided by 100 is provided in this subcategory. A Police Department should recognize that a BWC solution that requires an extensive policy and operational training effort will have a higher TCO.

These five categories represent the scope of this portion of the evaluation, and are considered to provide a substantial representation of the total cost of ownership associated with “deployment” costs. Other costs not explicitly stated here are not included in this evaluation.

Direct Ongoing Costs

Direct ongoing costs are the costs associated with services that are provided on an ongoing basis for general video management and storage. For this comparison, direct ongoing costs are provided in three subcategories:

1. **Video & Evidence Management Software:** This is the cost associated with providing evidence and video management software for each camera on a per month basis. This

cost is converted to an annual cost. This cost does not evaluate how the solution operates and any limitations or concerns associated with the solution. The MSRP is provided in this subcategory.

2. **Video Storage Cost:** This is the cost associated with storing video, either on local video data servers at the Police department or through cloud-based data storage such as Amazon AWS, Microsoft Azure, or another cloud storage provider. Some BWC solutions offer ‘unlimited’ data storage for a fixed fee. However, it is important to evaluate what ‘unlimited’ includes and does not include against departmental needs. Typically ‘unlimited’ requires a Police Department to have and adhere to their Video Retention Policy where data is purged according to the policy, and is therefore no longer subject to FOIA, Press, and Court requests. ‘Unlimited’ typically does not mean all video is stored forever. The MSRP is provided in this subcategory.
3. **Ongoing Device Support, Maintenance, and Replacement:** This is the cost associated with ongoing device technical support, device maintenance, and device replacement. The MSRP is provided in this subcategory.

These three categories provide a substantial representation of the total cost of ownership associated with “Direct On-going” costs. Other costs not explicitly stated here are not included in this evaluation.

Indirect Ongoing Costs

Indirect ongoing costs are the costs associated with products and services that are required as a result of BWC implementation on an ongoing basis. For this comparison, indirect ongoing costs are provided in three subcategories:

1. **Video Upload and Classification Labor Hours:** This is the cost associated with officer time spent uploading and classifying video during or after each shift. Using the national average for police officer salary, a cost estimate is generated by taking a percentage of that salary as it relates to the time spent by an officer uploading video and performing BWC video classification. Some solutions involve a police officer traveling to a docking station location after the end of a shift to plug the BWC into a docking station to upload video. It often takes several hours for video to be uploaded through the docking station. The police officer then has to return to the police station once again to classify the uploaded video. Based on how the classification is performed, the percentage is scaled up or down to estimate labor hour costs required to upload and classify video.
2. **Video Redaction Labor Hours:** This is the cost for redacting of BWC video to respond to Freedom of Information Act (FOIA), Press, and Court requests for a video. The privacy and visual identification of victims, minors, bystanders and police officers has to be protected before a video can be released. The staff time required to redact one hour of video is estimated from news reports and vendor solution demonstrations. The redaction labor hour cost is then scaled to an annual cost per BWC. The percentage of total hours of video that will need to be redacted is also estimated. Any software tools

required to perform redaction are already included in the Direct Cost for Video & Evidence Management software mentioned previously.

3. **Third Party Video Access:** This is the cost associated with Chain-of-Custody compliant evidence sharing amongst individuals within the justice system. Some vendors charge additionally for third party video access seat licenses or User Logins. It is assumed that video evidence access accounts will be provided for the Court staff, prosecution team, and defense team. This annual cost is divided by a 100 camera deployment to provide a per camera cost of additional third party video management software access.

These three categories represent the scope of this portion of the evaluation, and are considered to provide a substantial representation of the total cost of ownership associated with “indirect ongoing” costs. Other costs not explicitly stated here are not included in this evaluation.

Key Assumptions for Comparing BodyWorn™ to Alternatives

The TCO calculation methodology relies on several key assumptions. The rationale for each assumption is outlined in the following sections to allow readers of this comparison to better understand the basis of the resulting estimates.

Policy-Based Automatic Recording

It is important to note that the policy-based recording capabilities of the Utility BodyWorn™ solution are far more extensive than other BWC devices. Both BodyWorn and other BWC solutions can automatically start BWC recording when a light bar is turned on. In the case of other BWC solutions, a master control unit in the vehicle can broadcast a Recording Start message, and the BWC as a slave device will start recording. On the other hand, in the case of the Utility BodyWorn™, the BWC itself determines when to start recording based upon the status of multiple parameters, such as start recording when the police car light-bar is on, GPS speed is zero, and a police car door opens.

Utility’s solution further automatically starts recording using other sensors and triggers. Sudden motion such as running or a struggle, an officer going horizontal and not responding to verbal or tactile prompts from the BWC, an officer entering a predefined geo-fence or Action zone, when an officer is dispatched to a dynamic geo-fence zone based upon a central Computer-Aided Dispatch system, or when recording start is remotely triggered by Central Dispatch. These additional automatic video recording triggers increase video recording reliability while minimizing officer distraction and potential racial bias.

Device Training

This comparison assumes that BWC device training is necessary for a successful implementation of a BWC solution. This cost assumes that for every 20 BWC units deployed, 1 day of

professional training will be needed from the vendor. The International Association of Chiefs of Police (IACP) includes device training in their “Acquisition of New Technology” best practices guide. Two of the three methods of training suggested are provided by the technology vendor, suggesting that device training is best provided by a vendor, and almost certainly required for successful implementation of a new technology acquisition such as a BWC (Stolting, Barrett and Kurz).

Video & Evidence Management Software

This comparison assumes that the software solution provided by typical camera solutions and Utility are equivalent in features and functionality, when they likely are not the same. In particular, if GPS location data is embedded within the video, then video can be displayed in a map-based view. Furthermore, GPS-tagged video can also be searched by location. An in-depth comparison should be conducted in order to gain a better idea of the value provided by each video and evidence management solution.

Video Storage Cost and Reliability

This comparison assumes that the unlimited storage solution provided by other vendors and Utility are equivalent, when they likely are not. Some vendors charge an additional fee for video not originating from the vendor’s BWC. Cloud-based video storage can include automatic replication across multiple data centers, providing 99.999999% storage reliability. Local video storage that does not include automatic replication to remote back-up sites will be much more exposed to catastrophic video loss. An in-depth evaluation of each contract will provide insight as to the exact differences of each company’s version of unlimited storage.

Ongoing Device Support, Maintenance, and Replacement

This comparison assumes that the ongoing device support, maintenance, and replacement solution provided by other vendors and Utility are equivalent, when they have differences. An in-depth evaluation of each contract will provide insight as to the exact differences and value of each company’s maintenance, support, and hardware replacement policy.

Amount of Video Recorded

In order to create annual costs, assumptions on the amount of video recorded must be made. For this comparison, the amount of video that a department will collect annually per officer was based on a study conducted in Phoenix, AZ in 2011 during the early phases of body worn video rollout. The policy for recording used during this study reflects the policies adopted by many departments currently rolling out BWC programs, and should be fairly representative of the overall population of body cameras. It should be noted, however, that the amount of video recorded may be higher or lower depending on department policy and the frequency with which its officers face events that policy requires BWC video recording.

Based on this Phoenix study, an average officer activated their camera 414 times in a single year during which they would have had approximately 200, 10 hour shifts (assuming that they worked for 50 weeks during the year). This means that on average the camera was activated approximately 2.07 times each shift. Additionally, the mean recording time was 9.5 minutes, meaning that 414 videos would equate to approximately 65.6 hours of video recorded annually, per officer. These values are used as the basis for comparison in calculations made (Katz, Choate and Ready).

It is important to note that many RFPs, including a 2016 Phoenix body camera RFP, instruct bidders to assume a police officer will record an average of 2 hours of video per shift and approximately 200 shifts per year. This means the average police officer will record about 400 hours of video per officer per year on average. Which is more than six (6) times the volume of video recording used in this paper to calculate TCO. As an additional point of information, an NYPD body camera RFP instructed bidders to assume recording three hours of video per shift.

Redaction Costs

This comparison makes several assumptions to determine the cost of video redaction. The first assumption is that departments will redact video to fulfill FOIA, Press, and Court Officer requests for video. It is possible that some local and state governments attempt to exclude BWC footage from being subject to FOIA requests. However, this runs completely counter to 21st Century Policing guidance of transparent and accountable police operations, and will not stand up to political and public will that BWC video is a “matter of public record”. Therefore, exclusion of BWC video from public access will not be considered in this comparison.

The second major assumption required for estimating redaction costs is how much BWC footage will be collected by Police officers. As explained in the previous section, an early 2011 Phoenix pilot project showed approximately 65.6 hours of video recorded annually per officer. However, after events such as Ferguson MO, North Charleston SC, and Baltimore MD, Police departments are mandating that more types of public interaction will be recorded. Furthermore, 2015 and 2016 RFPs are mandating bidders assume 2-3 hours of video will be recorded per shift. Therefore this analysis assumes a police officer will record 2 hours per shift x 200 shifts per year on average, for a total of 400 hours of BWC video per officer per year.

The next assumption that must be made is how much of the video collected will need to be redacted. Since there is limited information on how much video actually is redacted by departments, a conservative estimate is applied in this comparison. This comparison assumes that 1% of all recorded video will need to be redacted. Therefore it is assumed that 4 hours of video will need to be redacted per officer per year.

Following the assumption of how much video will need to be redacted is how many hours of labor it will take to redact an hour of video. As a baseline, this comparison uses an estimate of 8 hours of labor to manually redact 1 hour of footage. This is supported by a study conducted in

Mesa, AZ where 3 videos, ranging in length from 1-2 hours, took 30.5 hours of labor to redact. Assuming the videos were 1.5 hours long on average, it would have taken 6.8 hours of labor to redact each video. While that is under the estimate being utilized, it is likely that the average video length was less than 1.5 hours, considering that the average length of a video recorded in the Phoenix study was just 9.5 minutes with 95% of BWC videos between 0 and 32 minutes long (TASER, Intl.). Further confirming this estimating factor, NYPD told new station NY1 that it would take an NYPD officer one year to redact 190 hours of pilot body-worn camera video. Assuming 1,600 hours of available work hours in a year, this equals 8.4 labor hours to redact one hour of video.

The final assumption that must be made is how much it will cost per labor hour to redact video. Recently, both Baltimore and New York have published costs for video redaction for their BWC pilot program. NYPD quoted a price of \$121,000 to reimburse NYPD for redacting 190 hours of pilot video. This results in a redaction cost per hour of \$636.84. Divided by 8.4 hours, the NYPD labor cost is \$75.81 per hour. This estimate appeared to be high for the average police department. Currently, Las Vegas charges individuals wishing to receive BWC footage at a rate of \$48 per labor hour for manual redaction. The Las Vegas rate of \$48 per labor hour for an average of 8 hours to manually redact an hour of BWC video (or \$384 per hour of video) is used in this comparison to determine an annual estimate of video redaction cost.

In summary, this comparison utilizes the assumption that manual redaction of video takes 8 hours per hour of video at a rate of \$48 per labor hour. Additionally, this comparison assumes that officers will record 4 hours of video that will be redacted annually. These numbers may be higher or lower based on employee productivity, local cost of labor, and other factors that would be Police Department specific.

Additional Video Management Access

This comparison makes several assumptions to determine a cost for additional video management access. The first assumption is that Police Departments will provide access to Courts and Prosecutors for evidence management. It is possible that agencies would prefer to download un-redacted video evidence to share with prosecutors, judges, and other interested parties for review. However, that presents chain-of-custody and security risks that this comparison does not support.

Other assumptions were made to reflect the approximate needs of most police departments that use the vendor provided Video Management Software to share evidence with the justice system. On that assumption, an article from Evidence Magazine stated that for 2300 BWC activations, video for 62 cases existed (Lovell). This means 2.7% of all recorded video pass through from BWC activation to court cases.

Based on the same assumptions used for video redaction, an officer will activate their camera at least twice during each shift with 200 shifts each year. At this rate, a 100 officer deployment will result in 41,400 annual camera activations, meaning that there will be approximately 1,116

cases where BWC footage will exist. If a local government operates 51 weeks each year, this is approximately 26 cases per week. If on average the full spectrum of court judges average 2 trials per week, then 11 accounts will be required to cover all judicial account needs. Assuming that the full spectrum of lawyers can operate with similar efficiency, a prosecutor and defense account will be needed for evidence review for every two cases handled each week, an additional 22 accounts. Adjusting for intermediate rounding, this means that for a 100 unit Police officer camera deployment, 33 additional video management accounts will be needed for the Justice system. This number may be higher or lower depending on how access is granted and taken away from those involved in the judicial system. A more detailed analysis for a specific agency would be necessary to fully understand how this element plays into body camera TCO.

Video Administration

This comparison assumes that an officer using a traditional BWC system will spend 30 minutes daily offloading and classifying their video after their shift. This number was taken from a report by the Berkley, CA police chief, citing that officers in surrounding areas where BWC systems had been implemented spent an average of 2 hours each week on BWC administration, referring to offload and classification (Meehan). Assuming a substantial learning curve and 4 shifts weekly, an officer will spend 15 minutes each shift offloading video. This is 2.5% of a 10-hour shift, resulting in a labor cost of approximately 2.5% of an officer salary. According to Glassdoor.com, an American police officers make a median salary of \$53,043 annually. 2.5% of this annual salary is \$1,326.08, translating to a \$1,326.08 classification and offload cost associated with a traditional BWC.

Findings

Utilizing the methodology and assumptions thus described, a total cost for each of the components listed has been derived. In this section, calculations and supporting data are included so that the comparison can be adjusted for varying data and assumptions.

Deployment Costs

Deployment costs are the cost of the device, peripheral devices, and introductory training for the device. It was found that BodyWorn by Utility costs \$500.00 to purchase one BodyWorn camera. Adding a Rocket IoT router to the vehicle provides real-time 4G-LTE, WiFi, BlueTooth, and Zigbee connectivity, vehicle diagnostic interface, 120GB of storage, and various sensors and triggers connected to the light bar, siren, doors, and other switches and triggers adds \$500.00. A typical camera cost \$1,250.00 to purchase the body camera, docking station, vehicle lightbar BlueTooth transmitter and training. Table 1 displays the results of the calculations for the five cost components outlined in the methodology for this comparison. Costs not applicable on a per device basis assume a 100 unit camera deployment, distributed equally per camera.

Table 1: One-Time Cost Comparison Results

BodyWorn by Utility, Inc.		Cost Component	Typical Clip-On Cameras	
The BodyWorn by Utility retails at \$500.	\$500	Device	\$400	Most cameras currently on the market cost around \$400.
BodyWorn uploads wirelessly via WiFi and does not require a docking station.	Not Necessary	Docking Station	\$250	A typical 6 bay docking station costs roughly \$1,500.
Rocket IoT Router includes 4G-LTE connectivity, video storage, triggers and sensors.	\$500	Policy-Based Automatic Recording	\$300	Devices to enable automatic recording cost roughly \$300.
The BodyWorn by Utility is equipped to review video in the field.	Built-In	In-Field Video Review Device	\$200	In field review screen devices such as an iPod Touch start at around \$200.
Utility provides training on its devices at no extra cost.	Included	Device Training	\$100	Training services are typically offered for around \$2,000 per day for a class of 20.
BodyWorn	\$1,000	Total	\$1,250	Typical Clip-On Camera

Device Training Calculation

Utility provides 1 day of training per 20 BWCs purchased. For a 100 unit camera deployment:

$$100 \text{ cameras} * \frac{1 \text{ day of training}}{20 \text{ cameras}} = 5 \text{ days of training}$$

Other vendors charge approximately \$2,000 per day of training, so for an equivalent amount of training:

$$5 \text{ days} * \frac{\$2,000}{\text{day}} * \frac{1}{100 \text{ cameras}} = \$100 \text{ per camera}$$

Therefore, for a service equivalent to Utility's, other vendors would charge \$100 per camera.

Direct Ongoing Costs

Direct ongoing costs are the cost of the video and evidence management software, video storage cost, and device support. Using the methodology and assumptions outlined, the total cost of direct ongoing costs for BodyWorn by Utility were \$900.00 annually. Other cameras were \$960 annually. Table 2 displays the calculation results for the three categories outlined under direct ongoing costs in the methodology section.

Table 2: Direct Ongoing Costs

BodyWorn by Utility, Inc.		Cost Component	Typical Clip-On Cameras	
Unlimited storage, with the AVail Web Video Management Platform costs \$75 per month.	\$900	Video & Evidence Management Software	\$960	Unlimited storage and software usage is generally charged monthly, at a rate of \$80 per month.
Unlimited storage of all evidence is included in the monthly subscription fee.	\$0*	Video Storage Cost	\$0*	Unlimited storage of video is often included, but some limitations may add cost.
Ongoing device support and maintenance is included. Replacement is included depending on contract length.	\$0*	Ongoing Device Support, Maintenance, and Replacement	\$0*	Ongoing device support and maintenance is included. Replacement is included depending on contract length.
BodyWorn	\$900	Total	\$960	Typical Clip-On Camera

*\$0 may not meet the requirements of some departments. Further needs analysis and cost research should be conducted.

Indirect Ongoing Costs

Indirect ongoing costs are the cost of redaction, additional video management access, and video administration. Using the methodology and assumptions outlined, the annual indirect ongoing costs for BodyWorn by Utility were \$649.22 annually. Results for typical clip-on cameras showed annual indirect ongoing costs as \$3,020.48 annually. Table 3 displays the calculation results for the three categories outlined under direct ongoing costs in the methodology section.

Table 3: Indirect Ongoing Costs

BodyWorn by Utility, Inc.		Cost Component	Typical Clip-On Cameras	
Utility provides Smart Redaction, an automated system that reduces redaction to a single assurance review.	\$384	Redaction Costs	\$1,536	Manual redaction at 8 labor hours per hour of video to be redacted.
Additional Video Management Software accounts are provided at no additional fee.	\$0	Additional Video Management Access	\$158.40	Competitors charge \$40 per month for additional Video Management Software accounts.
BodyWorn automatically offloads video wirelessly with limited classification automation. Full classification is completed on the device.	\$265.22	Video Administration	\$1,326.08	Video must be manually uploaded via docking station, USB cord, or Review device. Classification is manual.
BodyWorn	\$649.22	Total	\$3,020.48	Typical Clip-On Camera

Redaction Calculations

As stated in the Key Assumptions section, 8 labor hours is required to redact 1 hour of video manually. Labor is calculated at a rate of \$48 per hour. Given that an officer will produce 4 hours of video that needs to be redacted per year, at a manual redaction productivity level, the annual redaction cost would total \$1,536 per camera. Table 4 provides productivity improvement estimates, and the number of labor hours required to redact one hour of video.

Table 4: Labor Hours to Redact Video

	Smart Redaction by Utility	Manual Redaction
Estimated Labor to Video Ratio	2:1	8:1
Productivity Improvement	75%	-
Labor Hours to Redact One Hour of Video	2	8

Using the Table in 2.4:

Utility Redaction Cost

$$4 \text{ hr video, annually} * \frac{2 \text{ labor hr}}{\text{hr video}} * \frac{\$48}{\text{labor hr}} = \$384 \text{ annually}$$

Typical Assisted Redaction Cost

$$4 \text{ hr video, annually} * \frac{8 \text{ labor hr}}{\text{hr video}} * \frac{\$48}{\text{labor hr}} = \$1,536 \text{ annually}$$

Justice System Video Management Account Cost Calculation

As explained in the key assumptions section, a 100 unit camera deployment will require at least 33 additional video management accounts. Utility offers additional accounts for \$0.00, so the calculation is not necessary. The cost of Additional Video Management Accounts for a typical solution is calculated below:

$$33 \text{ accounts} * \frac{\$40}{\text{account} * \text{month}} * \frac{12 \text{ months}}{\text{year}} * \frac{1}{100 \text{ cameras}} = \$158.40 \text{ per camera}$$

Video Administration Calculations

As stated in the Key Assumptions section, a docking station-based BWC camera system requires 15 minutes of video administration daily to upload and classify video out of an officer's shift. This assumes the Police Officer is not making a special trip just to dock and classify video recorded during the shift. However, if officers have to take time or get paid overtime solely to travel to a docking station location to upload and classify video, then this docking station video administration cost is seriously understated.

BodyWorn by Utility offers productivity benefits over a traditional BWC camera system by partially automating video classification using embedded GPS to tag video with location metadata. The remainder of classification takes place immediately on the BWC device by the officer at the scene. Additionally, video is automatically uploaded wirelessly, rather than being manually uploaded at a central base station. Typical clip-on cameras do not provide these productivity benefits. Table 5 presents data regarding the estimated productivity improvement for each system.

Table 5: Productivity Improvements in Video Administration

	BodyWorn by Utility	Typical Clip-On Camera
Estimated Productivity Improvement	80%	0%
Daily Officer Time Requirement	3 minutes	15 minutes

Using the data in Table 5 and that an officer works 4-10 hour shifts weekly:

Utility Video Administration Cost

$$3 \text{ min daily} * \frac{1 \text{ hr}}{60 \text{ min}} * \frac{1 \text{ day}}{10 \text{ hr}} = .5\% \text{ of time}$$

$$\frac{\$53,043 \text{ officer}}{\text{year}} * .5\% = \$265.22 \text{ annually}$$

Typical Video Administration Cost

$$15 \text{ min daily} * \frac{1 \text{ hr}}{60 \text{ min}} * \frac{1 \text{ day}}{10 \text{ hr}} = 2.5\% \text{ of time}$$

$$\frac{\$53,043 \text{ officer}}{\text{year}} * 2.5\% = \$1,326.08 \text{ annually}$$

Overall Findings

Combining the data listed above, the findings are summarized and listed below. Total up-front cost of ownership for a BodyWorn by Utility is estimated at \$500.00 plus \$500.00 for a Rocket IoT router. In The ongoing, annual cost of owning a BodyWorn by Utility is estimated at \$649.22 annually. The total up-front cost of a typical camera is \$1,265.00. The ongoing, annual cost of owning a typical camera is \$3,020.48 annually. Table 6 displays the overall cost findings. Table 7 displays the lifetime cost of each device, given a 5-year life span.

Table 6: Overall Cost Findings

	BodyWorn by Utility	Typical Clip-On Camera
One-Time Cost	\$1,000.00	\$1,265.00
TOTAL One-Time	\$1,000.00	\$1,265.00
	BodyWorn by Utility	Typical Clip-On Camera
Direct Ongoing	\$900.00	\$960.00
Indirect Ongoing	\$649.22	\$3,020.48
TOTAL Ongoing	\$1,780.15	\$3,980.40

Table 7: 5-Year Lifetime Cost by Device

	BodyWorn by Utility	Typical Clip On Camera
One-Time Costs	\$1,000.00	\$1,250.00
Direct Annual Costs x 5 years	\$4,500.00	\$4,800.00
Indirect Annual Costs x 5 years	\$3,246.10	\$15,102.40
Lifetime Cost All Costs Considered	\$8,746.10	\$21,152.40

With the Utility BodyWorn solution, the Police Department gets a full vehicle wireless router that can also serve as an In-Car Video system with the simple addition of front facing and backseat IP cameras. In practice, the Rocket IoT router can serve as a wireless docking station for BodyWorn cameras that are uploading video as it is being recorded. Furthermore, all vehicle and BodyWorn video is stored in an integrated and unified Video Management system, where all vehicle and BodyWorn video related to an Incident can be displayed as multiple panels in one integrated and time synchronized view of an Incident.

Conclusions

Based on this comparison analysis, BodyWorn by Utility is 41.3% of the five (5) Year TCO over a typical clip-on manually operated body camera. The productivity benefits offered by Utility's technology and software reduces the five (5) year Total Cost of Ownership by \$12,406.30 per camera. The savings are all in the cost savings in Video Administration and Redaction.

Departments concerned about the cost of their current BWC solution or a solution they hope to implement should conduct an independent validation of the Total Cost of Ownership analysis for their specific department. However, reducing the five (5) year Total Cost of Ownership by more than half while providing a far more capable solution can only be good for the stewardship of public resources.

Works Cited

- Anderson, Julie. "Cloud Storage for Camera Data?" *Emergency Management*. Ed. Jim McKay. Folsom, 8 February 2016. Article.
- Glassdoor.com. *Police Officer Salaries*. 23 March 2016. 28 March 2016. <https://www.glassdoor.com/Salaries/police-officer-salary-SRCH_KO0,14.htm>.
- Katz, Charles M., et al. *Evaluating the Impact of Officer Worn Vody Cameras in the Phoenix Police Department*. Document. Phoenix, AZ: Arizona State University, 2014.
- Las Vegas Metropolitan Police Department. *Body Worn Camera Recordings*. n.d. 28 March 2016. <<http://www.lvmpd.com/Records/BodyWornCameraVideo/tabid/583/Default.aspx>>.
- Lovell, Steve. *Body-Worn (Video) Evidence*. January 2015. 28 March 2016. <http://www.evidencemagazine.com/index.php?option=com_content&task=view&id=1585>.
- Meehan, Michael K. *Body-Worn Cameras for Police Officers*. Memo. Berkeley, CA: City of Berkeley, 2015.
- Miller, Lindsay, Jessica Toliver and Police Executive Research Forum. *Implementing a Body-Worn Camera Porgram: Recommendations and Lessons Learned*. Washington, DC: Office of Community Oriented Policing Services, 2014.
- Police Executive Research Forum. *Future Trends in Policing*. Washington, DC: Office of Community Oriented Policing Services, 2014.
- Reaves, Brian and Andrea Burch. *Census of State and Local Law Enforcement Agencies, 2008*. Document. U.S. Department of Justice. Washington ,DC: The Bureau of Justice Statistics, 2011.
- Stolting, Cpt. Sharon, Cpt. Shawn Barrett and Chief David Kurz. *Best Practices Guide, Acquisition of New Technology*. Document. Alexandria, VA: International Association of Chiefs of Police, n.d.
- TASER, Intl. *End of Program Evaluation & Recommendations*. Document. Mesa, AZ: TASER, Intl., 2013.
- . *Evidence.com Pricing*. n.d. 28 March 2016. <<http://www.axon.io/pricing>>.
- . "Taser, Pricing & Ordering." 18 November 2015. *Charlotte Cooperative Purchasing Alliance*. 28 March 2016. <<http://www.charlottealliance.org/pdf/taser-international/TASER%20International%20Pricing%20-%20Amendment%202%20Addl%20Products.pdf>>.

