



**Homeland
Security**

Science and Technology

Summary

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective operational tests and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

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In-Car Camera Systems

(AEL reference number 04MD-01-VCAM)

In order to provide emergency responders with information on the capabilities, limitations, and usability of currently available in-car camera systems, the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic conducted a comparative assessment of in-car camera systems for the SAVER Program in December 2008. Detailed findings are provided in the complete In-Car Camera Systems Assessment Report, which is available by request at <https://www.rkb.us/saver>.

Background

An in-car camera system is a closed-circuit television (CCTV) system that is primarily used in law enforcement patrol vehicles. Typically consisting of a forward-facing camera, microphones, a video monitor, and a digital video recorder (DVR), the system can be used to record audio and video of police interactions with the public. For added functionality, some in-car camera systems interface with a mobile digital computer (MDC) and a global positioning system (GPS) receiver. In addition, some in-car camera systems are able to transmit captured audio and video wirelessly.

Although in-car camera systems are primarily used in law enforcement vehicles, there has been recent interest in using them in fire and emergency medical vehicles as well. In-car camera systems can provide audio/visual evidence in investigations, document emergency responder actions, and protect emergency responders against false allegations.

Assessment

A focus group of seven emergency response practitioners within the law enforcement community met in May 2008 to identify equipment selection criteria, evaluation criteria, and assessment scenarios. Based on focus group recommendations and market survey research, six in-car camera systems were selected for assessment. Vendors of each of the six in-car camera systems were invited to participate in the assessment; however, three vendors were unable to participate due to logistical and scheduling conflicts. The following three in-car camera systems were included in the assessment:

- Coban Technologies TopCam II
- ICOP Digital Model 20/20-W
- WatchGuard Video DV-1.

Four emergency response practitioners served as assessment evaluators, and they assessed one in-car camera system per day. Prior to beginning the assessment, evaluators were provided step-by-step procedures to ensure consideration was given to each assessment criterion. Each day began with product orientation and training, and then each evaluator took a turn operating the in-car camera systems from the front passenger seat of a vehicle.

The assessment was conducted in two phases that focused on specific assessment criteria. Phase I involved the operational assessment of the in-car camera systems. Evaluators assessed each product based on their interaction with the systems. Criteria directly relating to a responder’s ability to use the product were rated by the evaluators in the first phase of the assessment. There were two segments—setup and scenario—in this phase, and the scenario segment was conducted during both daytime and nighttime conditions.

Phase II was the specification assessment. In this phase, evaluators assessed each product based on vendor-provided information. They addressed criteria related to features, pricing, and support information that were not operationally assessed during Phase I of the assessment.

Assessment Results

Evaluators rated the in-car camera systems based on the evaluation criteria established by the focus group. Each original criterion was assigned to one of the five SAVER Program categories, and each category was assigned a weighting factor to indicate its impact on the total composite score. The SAVER Program category and composite scores are shown in table 1. Higher scores indicate better performance. To view how each in-car camera system scored against the individual assessment criteria assigned to the SAVER Program categories, see table 2.

All three products scored favorably overall, indicating only slight differences in the overall performance between the in-car camera systems. Table 3 provides product specifications; however, all of the products in the assessment offered the following:

- Multiple mounting options
- On-site installation, installation training, and user training

SAVER Program Category Definitions

Affordability: This category groups criteria related to life-cycle costs of a piece of equipment or system.

Capability: This category groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more responder-relevant tasks.

Deployability: This category groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.

Maintainability: This category groups criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders.

Usability: This category groups criteria related to the quality of the responders’ experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

- Batteries that provide at least 8 hours of talk time per battery charge and can recharge in 4 hours or less
- Capability to simultaneously record one omni-directional in-car microphone and two wireless microphones that are weather resistant
- Capability to interface with infrared components and up to three cameras
- A 1-year warranty and extended warranty offer at an additional cost
- A configurable resolution with a maximum resolution of 720x480 pixels.

The following paragraphs provide a brief summary of the evaluator comments and feedback on each in-car camera system and present the devices from the

Table 1. In-Car Camera Systems Assessment Results¹

In Car Camera System	Composite Score	Affordability (20% Weighting)	Capability (33% Weighting)	Deployability (10% Weighting)	Maintainability (10% Weighting)	Usability (27% Weighting)
TopCam II	90	80	90	86	86	96
Model 20/20-W	86	80	90	90	68	88
DV-1	82	84	80	90	76	84

Note:




¹ Scores contained in the assessment report may be displayed differently. For the purposes of the SAVER Summary, all SAVER category scores are normalized using a 100-point scale and rounded to the nearest whole number.

highest to lowest composite score. The complete assessment report includes a breakdown of evaluator comments by individual criterion.

TopCam II

Coban Technologies' TopCam II received the highest capability, usability, and maintainability scores, as well as the highest overall composite score. Evaluators reported that the TopCam II is a software-based system that is Microsoft® Windows® compatible. They stated that the system settings are configurable at the server level by an administrator and can be wirelessly downloaded to patrol vehicles in the field. The TopCam II is equipped with internal and external hard drives and utilizes a touch screen monitor for menu navigation when setting up the system and replaying video. Evaluators noted the TopCam II's user interface is a favorable feature. They agreed that the system has excellent user controls and indicated that the system is easy to power on. They remarked that the one lux camera provided clear, detailed video during the daylight scenario and they were pleased with the audio quality of the remote microphone, even at a distance of 600 feet while using only the internal antenna. Evaluators considered the remote microphone's external antenna to be small and flexible and liked that the microphone can be worn horizontally on their belt to keep it from interfering with their movement. They favored the remote microphone's light emitting diode (LED) indicators and especially liked the corresponding legend printed on the back of the microphone. Evaluators indicated that the forward-facing camera is small, mounted solidly, and is easy to position to capture other fields of view. They were impressed with TopCam II's video storage capacity and ease of use when labeling and replaying video in the vehicle. Evaluators also indicated that the TopCam II is relatively easy to maintain.




Although evaluators agreed that the TopCam II offers numerous advantages, there were also several disadvantages noted as well. Evaluators stated that the video quality is poor during nighttime conditions. Most of them thought the zoom buttons, located on the back of the camera, are difficult to access and found the zoom somewhat slow in capturing the suspect's license plate while the vehicles were moving. Evaluators considered the price and extended warranty options of the TopCam II to be a little expensive and reported that the manufacturer does not offer live 24/7 phone support. Additional concerns included potential deployability issues such as the mounting

	 Pros	<ul style="list-style-type: none"> • Touch screen monitor • Ease of use when reviewing and labeling video • Video quality in daytime conditions • Audio clarity • Interface capabilities with MDC • Wireless data transmission • Amount of buffered video • DVR storage capacity • User controls
	 Cons	<ul style="list-style-type: none"> • Video quality in lowlight conditions • Limited manufacturer technical support • Camera zoom
TopCam II		Composite Assessment Score: 90

configuration and operating temperatures. Evaluators explained that the overhead mounting is bulky and can possibly obstruct an officer's field of view. They also expressed concern that patrol vehicles could exceed the maximum operating temperature when sitting for extended periods in the hot sun.

Model 20/20-W

ICOP Digital's Model 20/20-W received the second highest overall composite score, and it was one of the two in-car camera systems that received the highest capability score and deployability score. Evaluators reported that the Model 20/20-W is a server-based solution with administrator-configurable system settings at the server level that can be downloaded to patrol vehicles in the field. The model also incorporates a removable hard drive, monitor, and radio into one unit that replaces the patrol vehicle's dashboard AM/FM radio. Evaluators were pleased with the DVR storage capability and noted that the Model 20/20-W's video clarity is excellent, even during nighttime conditions. They agreed that the remote microphone provides excellent audio quality inside buildings and at distances up to 600 feet, and the in-car microphone provides quality audio as well. The Model 20/20-W is equipped with a GPS receiver, and evaluators liked that GPS coordinates are displayed on the video monitor and can be used to bookmark events. Evaluators considered the model's user interface favorable: it is activated when the patrol vehicle is turned on, but can also be configured to require a password for activation. The microphone clearly indicates when recording is activated, and evaluators found the microphone's external antenna to be helpful in protecting the record button against accidental activation. Evaluators indicated that the

	 Pros	<ul style="list-style-type: none"> • Video quality • Audio quality • Wireless data transmission • Auto-zoom and auto-focus capabilities
	 Cons	<ul style="list-style-type: none"> • Pre-event record time is not configurable • Security of hard drive • Labeling of recorded video
Model 20/20-W	Composite Assessment Score: 86	




forward-facing camera is small, solidly mounted, and adjustable. They stated the camera's auto-zoom and auto-focus capabilities are excellent, and they were impressed with its ability to quickly and clearly capture the target vehicle's license plate in both daytime and nighttime mode. Evaluators considered the price of the Model 20/20-W to be fair and the unit relatively easy to maintain.

While evaluators were generally pleased with the Model 20/20-W, they did note that the fixed 1-minute pre-event record time would be too long for most agencies, and indicated a preference for a user-configurable, pre-event record time. Some evaluators felt that a battery life indicator would be beneficial. Most of the evaluators expressed concern about the physical security of the removable hard drive. They stated that the hard drive is located behind a reinforced face plate that opens using a pass code; however, they thought the face plate could be forced open using a standard screwdriver. Evaluators commented that labeling the recorded video is cumbersome and that labeling parameters are limited. They noted that still pictures cannot be captured from recorded video while in the vehicle; this can only occur after the video has been uploaded to the server. Evaluators did not like the multifunction video playback control buttons; they preferred designated playback buttons or touch screen controls. Evaluators stated that the extended warranty options are a little expensive, and they noted the manufacturer does not offer live 24/7 phone support (call-back support is offered after regular business hours). Evaluators indicated that the fixed monitor included with the agency's MDC would interfere with the dashboard radio-mount configuration. The configuration would also prevent users from having a compact disk player in the patrol vehicle. Finally, evaluators expressed some concern about the minimum and maximum operating temperatures.

DV-1

WatchGuard Video's DV-1 received the lowest overall composite score; however, it received the highest affordability score and tied with the Model 20/20-W for the highest deployability score. Evaluators reported that the DV-1 is a stand-alone system that records audio and video to a rewritable digital versatile disk (DVD), and its internal hard drive continually buffers video from which DVDs can be created. Evaluators were pleased with the DVR storage capacity and liked that the resolution and pre-event record time are user-configurable. Evaluators were impressed with the DV-1's video quality during daytime conditions, and agreed that the in-car and remote microphones provide excellent audio clarity. They found that it is easy to separate the in-car audio from remote audio during playback. Evaluators liked that the remote microphone has no external antenna to restrict movement. They noted that the DVD is adequately secured with a lock and the internal hard drive can only be reformatted by a supervisor with a pass code. Evaluators were pleased with the DV-1's capability to capture still pictures during playback. They agreed that the DV-1 is user-friendly, its user interface is favorable, and its price and extended warranty options are comparable to the other systems. Evaluators stated that the DV-1 is relatively easy to maintain, and 24/7 phone support is offered by the manufacturer. Evaluators also reported that the DV-1's operating temperature range is broader than typical operating temperature ranges and would be acceptable for most U.S. law enforcement agencies.

Although evaluators liked the ability to eject the DVD and play it back on a computer, they noted that it takes a long time to burn video and audio to a DVD for

	 Pros	<ul style="list-style-type: none"> • Video quality in daytime conditions • Audio quality • Audio and video are recorded to re-writable DVD • 24/7 phone support • Operating temperature • Auto-zoom and auto-focus capabilities in daytime conditions
	 Cons	<ul style="list-style-type: none"> • Video quality in lowlight conditions • No wireless transmission • Recording to DVD is slow • Auto-zoom and auto-focus in nighttime conditions
DV-1	Composite Assessment Score: 82	

playback in a vehicle. This could create challenges for users needing to create multiple DVDs during a shift. Evaluators reported that watermarking is not used to authenticate the video and expressed concern that the software authentication could be problematic in court. Some evaluators mentioned that the control buttons are difficult to see and the menus are difficult to navigate. They noted that there is a 3- to 4-second delay after activation before the remote microphone starts recording. Evaluators commented that it is easy to accidentally activate recording due to the record button not being protected. Some evaluators indicated that the controls are not intuitive when reviewing video, and the auto-zoom and auto-focus capabilities are difficult to use at night. In addition, evaluators sometimes found it difficult to manipulate or effectively capture the license plate numbers of moving vehicles. Evaluators reported that the DV-1 has a 3-hour battery recharge time, no wireless transmission capabilities, and potential limited visibility due to the overhead mounting configuration of the unit.

All reports in this series as well as reports on other technologies are available by request at <https://www.rkb.us/saver>.

Conclusion










































































Representatives from the law enforcement community evaluated three in-car camera systems. All three products scored favorably overall. Coban Technologies' TopCam II received the highest composite score, followed by ICOP Digital's Model 20/20-W, and then WatchGuard Video's DV-1.

Evaluator comments highlighted the following items for emergency response agencies to consider when evaluating in-car camera systems for procurement purposes:

- Clear audio and video during day and night operations
- Ample storage capacity
- Ability to authenticate the video and audio
- Ease of use when replaying the audio and video in the vehicle
- Ability to interface with an MDC
- Wireless transmission capability
- Affordable extended warranty options
- Technical support availability.

Emergency responder agencies considering adding in-car camera systems to their current set of resources should carefully consider each device in light of its overall capabilities and limitations and the needs of their agencies.

Table 2. SAVER Category and Criteria Scores¹

KEY				
Least Favorable		Most Favorable		
				
		TopCam II	Model 20/20-W	DV-1
Assessment Criteria				
Affordability				
Price				
Warranty				
On-site Installation				
Capability				
High Quality Audio/Video				
Camera				
Microphone				
Audio/Video Integrity				
Pre-event Record Option				
In-car Microphone				
DVR Storage Capacity (in-car)				
Storage Options				
Resolution and Frame Rate				
Triggers				
Labeling				
MDC Interface				
Secure Wireless Transmission				
GPS Capable				
Flexible Inputs				
Wireless Local Area Network				
Still Picture Capture				
Deployability				
Mounting Options				
Operating Temperature				
Small Microphones				
Weather-resistant Microphones				
Installation Training				
Maintainability				
System Reliability				
Manufacturer Technical Support				
Batteries				
Quick Battery Recharge				
Usability				
Remote Trigger on Microphone				
Officer Training				
Interface				
View until Download				
Wireless Data Transmission				
Battery Life				
Microphone Antenna				
Small Cameras				
Zoom Capability				

Note:

¹ Averaged criteria ratings for each product that was assessed are graphically represented by colored and shaded circles. Highest ratings are represented by full green circles.

Table 3. In-Car Camera System Specifications

Specifications			
	TopCam II	Model 20/20-W	DV-1
Price	\$5,500	\$5,200	\$4,995
Operating Temperature	22°–122° F	-22°–176° F (DVR) and 32°–122° F (camera)	20°–158° F
Storage Options	60 GB removable hard drive and 40 GB internal hard drive	40 GB removable hard drive	DVD and 40 GB internal hard drive
DVR Storage Capacity (In-car)	Up to 80 hours	Up to 68 hours	Up to 8 hours (DVD) and up to 40 hours (hard drive)
Frame Rate	Fixed at 30 fps	Configurable at 30, 15, or 10 fps	Fixed at 30 fps
Pre-event Record Option	Configurable by administrator	Fixed at 1 minute	Configurable by user (various increments from 0 to 10 minutes)
MDC Interface	Yes	No	No
Wireless Data Transmission	Yes	Yes	No
Secure Wireless Transmission	Can be set to WEP, WPA, or WPA2	Configurable to WEP or WPA	Not applicable
Wireless Local Area Network	802.11 protocols	802.11 protocols	Not applicable
Recording Triggers	Manual, remote microphone, siren, lights, and 8 configurable inputs	Manual, remote microphone, siren, lights, speed, and 3 configurable inputs	Manual, remote microphone, siren, lights, and crash detection sensor
Manufacturer Technical Support	Live phone support, M-F, 8:00 a.m.–5:00 p.m. CST	Live phone support, M-F, 8:00 a.m.–8:00 p.m. EST, call back support available after hours, and Web-based support	24/7 phone and Web-based support
Extended Warranty Options	2-year warranty: \$300 3-year warranty: \$700	2-year warranty: \$316 3-year warranty: \$636 4-year warranty: \$1,036 5-year warranty: \$1,995	2-year warranty: \$250 3-year warranty: \$560 4-year warranty: \$945 5-year warranty: \$1,430 or \$1,000 at time of purchase