

SPECIAL REPORT:

The PATROL VIDEO Project

BY TIM DEES

For the last couple of years, *LAW and ORDER* has chosen some niche of the police technology market to explore and review comprehensively. Two years ago, we reviewed ruggedized laptops, and the year after, handheld computers. When we went after in-car video systems (called patrol video hereafter), we never knew that it was going to be such an undertaking. This project began just about the time that most of the major patrol video manufacturers were revamping their product lines to use digital video recording technology. While everything from watches to cameras seems to be digital these days, the difference is not always immediately evident to the user. That isn't the case with digital patrol video.

Digital technology isn't just a little bit better than analog for patrol video. It's a lot better. Departments that have been using analog video systems for some years have amassed warehouses full of videotapes, most of them book-size VHS tapes, that have to be cataloged, tracked and copied for courtroom use. The tapes and the recordings on them degrade over time, so it's entirely possible that these departments are spending money on the tracking of landfill-grade plastic cassettes and Mylar tape, rather than video programs.

It's not uncommon for one or more persons to have as their sole assignment the management of these tapes, adding personnel costs to those of storage and maintenance.

Digital systems have several clear advantages to analog. The media, no matter what kind you use, is smaller. Mini-DV tapes are a fraction of the size of VHS cassettes. DVD disks are smaller still. If the video is archived onto a server, months or years of video can be kept on hand in a space the size of a walk-in closet.

With all but tape-based digital media, access to any portion of the recording is immediate. It's the difference between trying to view a specific scene in a movie on a VHS cassette versus a DVD. On the cassette, you have to fast-forward and reverse until you get to the clip you want. On a DVD, you pick the scene from a menu and view it instantly.

Server-based video can be viewed from any computer networked to that server. An officer can prepare for court by viewing the video of the incident from any computer in the station. Supervisors can show citizens the recordings of their traffic stops while they are in the office. There's no need to call the video clerk and have him retrieve the cassette you want. You input the time, date, and unit number (or other data), and there it is.

The video clips are easy to copy. Even cheap VHS cassettes cost a dollar

or more each, and most of the capacity is wasted when the incident in question runs only a few minutes. Recordable CDs are now as cheap as floppy disks at \$0.50 or less in quantity, and they will easily hold just about any typical video clip. They can also be created in a few minutes, where copying video is usually done in real time, e.g., a 30-minute video clip requires at least 30 minutes to copy.

It's much easier to manage. Many of the manufacturers whose systems we examined sell "back end" management software to catalog the video clips and make them more easily retrievable. There is usually no need for a person to manage the video system—the computer does the heavy lifting for you.

Digital video can carry much more information than its analog counterpart. Analog systems did well to overlay the video picture with the time, date, unit number and/or officer name, agency name, and status of emergency lights. It wasn't uncommon for there to be so many text overlays on the screen that it was difficult to see the picture. Digital video systems can store all of this information with every recorded frame, plus the traffic radar output, GPS coordinates, CAD incident numbers, the status of the brakes, siren, lights, seat belts, and speed of the car. This information can be shown on the video display, or just stored with each frame for later reference, if needed. As there are typically 30 frames per second of video, this information is updated that often.

Digital systems can usually record more than one channel of video at a time, and can continue to record while a segment is being played back. An officer can review the details of a traffic stop while his prisoner in the back seat continues to star in his own production of *COPS*. When the officer drives to the jail, the front-looking camera captures the view out of the windshield while the prisoner cage camera records what is going on there, often covertly.

DIGITAL VIDEO

But the big selling point for digital video is a feature with the mundane name of "pre-event recording." Here's your scenario: you are sitting at a traffic light, car in drive and brain in neutral, when the light changes to green for traffic in your lane. You start to move forward when Maladroit Leadfoot blows through the intersection two seconds behind the red light, giving you the one-finger salute as he passes by. You shift the lightbar into Christmas Time, go after and catch Maladroit, but wouldn't it be grand if his performance in the intersection was available for the traffic court judge to see? Well, on reviewing the recording that was initiated when you turned on the lightbar, for example, you find that it begins with 20 seconds or so of dull intersection-watching, when Mr. Leadfoot makes his breathtaking entrance, and your brief pursuit and stop follows. How can this be?

Most of the new digital patrol video systems are in a passive recording mode whenever there is power to the system. The recording is captured by a solid-state memory chip with a capacity of anywhere from 10 seconds to five minutes, depending on the system setting and the manufacturer. This means the last 10 seconds to five minutes is always available to the system.

When the officer puts the system into record mode, the contents of that memory device are dumped to the recording medium, and everything else that follows is appended to the end of that sequence. Thus, any recording made by the officer will actually start 10 to 600 seconds before he commands the system to record. The sudden lane change of the DUI, the suicidal pedestrian who walks out in front of you, the idiot who blows through the red light are all recorded for introduction in court. It's a beautiful thing.

Compelling as they are, don't expect to use these recordings in court a lot. The Yakima, WA, Police Department has been using an all-digital system

from Coban in their cars for about a year. Yakima PD has 130 officers, and they produce, on average, two hours of video per officer per shift. A clerk is assigned to respond to requests from citizens, prosecutors, and defense attorneys for copies of incident recordings, and she makes about 50 CDs a week. How many have come into court? None. Zero. Zilch. Not any.

Most of the time, the people depicted on the recordings decide that it would not be in their best interests to have their performances seen in a court of law. The services of the video clerk are paid by YPD, of course, but it costs far less to have her produce those CDs on regular time than it would to have officers appear in court on overtime. If you need a bottom line, return-on-investment argument, there it is.

How do the troops feel about the new video systems? There is almost always an initial feeling of dread and paranoia, as officers fear that the new systems will be used to jam them up and catch them doing things that they aren't supposed to do. One department's officers quickly developed a code phrase to determine if they were being recorded: "Is Mike here?" If the video system wasn't recording, Mike was gone that day. Otherwise, Mike was riding along.

Even if the initial reaction was one of fear and dread, everywhere we went, officers with the video systems came to love them, and when they weren't fully deployed, fought over the cars that had them. Hermiston PD Officer Will Jons said of his Kustom Digital Eyewitness system, "I love the new system. I get evidence that I wouldn't get otherwise, and see mistakes I'm making. I review every one of my stops and critique myself or the reserves that ride with me. It's making me a better cop."

The Method

We contacted every patrol video manufacturer that we could find and

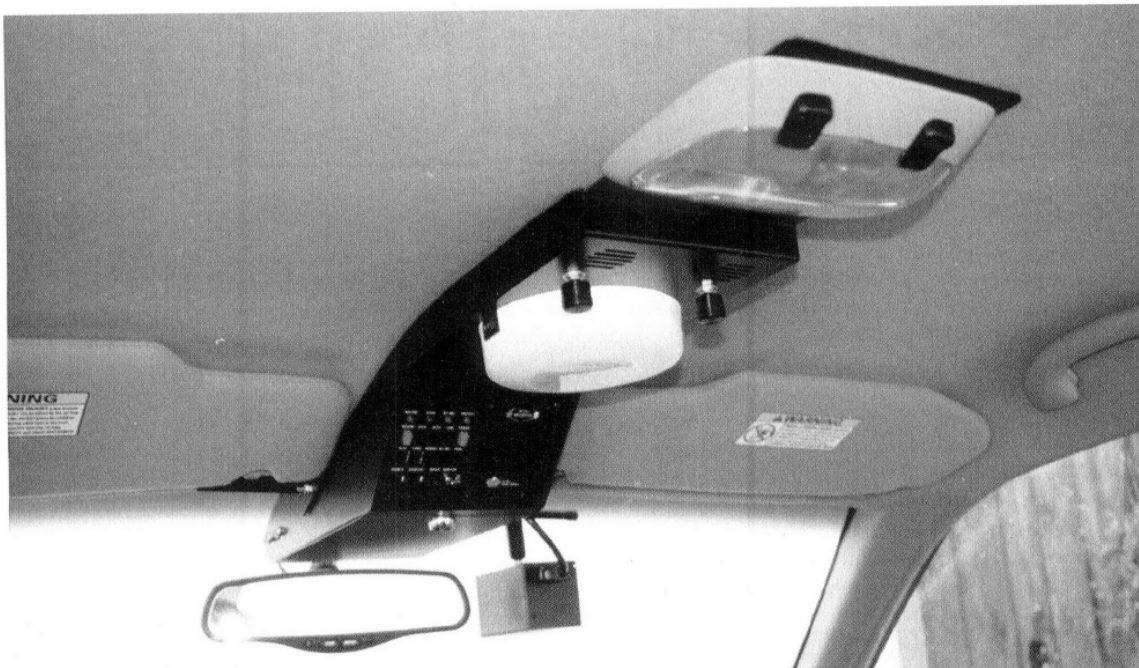
asked them to submit a system for testing. Those that sent hardware had the systems installed in the cars of the Hermiston and Umatilla Police Departments in Eastern Oregon. Hermiston has about 25 officers, Umatilla eight. Other departments were asked to participate, but didn't want to have their cars dissected to have these systems installed. Chiefs Dan Coulombe at Hermiston and Travis Eynon at Umatilla saw the opportunity to get the use of some gear for free, and took us up on our offer. Had these progressive chiefs not given their help, this project would have gone nowhere. *LAW and ORDER* thanks you, chiefs.

A couple of manufacturers, namely Coban and Sequent, had full installations at other departments, and brought us in to look at them. These systems got the same level of review as those where we had the equipment evaluated locally. Some manufacturers didn't send equipment for us to test. The specifications and features of their systems are mentioned here, but only in the context of the manufacturers' claims of performance and features.

One thing that became clear as we went through all of these installations was that they are best done by a professional. Many city vehicle shops that do routine maintenance on police cars will find the installation of these video systems challenging. If you do decide on a vendor, check with them to see if they can recommend an experienced installer.

McCoy's Law Line
<http://www.policeradar.com>

The McCoy's equipment was the first that we installed, the only one that I installed personally, and possibly the most basic and compact of all the units reviewed. This is a Hi-8 based recorder, contained in a lockable compartment that bolts onto the headliner. Hi-8 is a tape-based analog format, where the tape is about the same size as an audio



cassette, although somewhat more expensive. Two to four hours of continuous video can be stored on a tape, depending on the speed setting.

The McCoy's unit is a good choice for agencies with a minimum of installation expertise, and that want to minimize the renovations to the inside of the vehicle. The fact that this writer was able to get the system installed and working at all is a testimonial to its simplicity (given the simplicity of the author). Even so, it took me about five hours longer than it would have taken someone who knew what they were doing.

The entire unit, including recorder/player, control panel, display, and camera, all reside in or are attached to a single module that bolts to the sun visor attachment and dome light assemblies. Anyone who can install a car stereo can put in one of these systems. The number of cables that need to be routed under the headliner and down the roof pillars is minimal as compared to the other systems tested, most of which have additional components under a seat or in the trunk.

The McCoy's system provides for only a single channel of video from the camera that is normally pointed forward. If an officer wished to record a

prisoner in the back seat, he would have to turn the camera around. This isn't anything difficult, but the view to the front is lost. There is a port on the system to accommodate a second camera, if a rear view is desired. The audio channel comes from a pager-sized transmitter and microphone carried by the officer, and powered by a single 9-volt battery. If the officer turns on the remote mike within the range of the system (several hundred feet, depending on conditions), the system will go into record mode automatically.

The system provides for markers to appear on the display (and thus on the recording) when the vehicle's siren, emergency lights, and/or brakes are active, but these features weren't enabled (mainly because I didn't know how to hook them up) in our test setup. This system worked as advertised, so there is no reason to think that these options wouldn't have functioned just as well.

The monitor and control buttons are integrated with the overhead console. The monitor is an LCD screen that can be dimmed during night operation, or shut off completely. There is also a setting that turns off the monitor when the system is not in active record or playback mode. When an officer does

choose to play back a segment of the tape, recording stops. The tape can be fast-forwarded or rewound to find the segment of interest, and then it plays back with the audio track playing through a built-in speaker. If the officer puts the system back into record mode while the system is replaying a segment, the start of the recording will be delayed while the recorder advances to the first unrecorded portion of the tape. This is to ensure that no recorded portion of the tape is erased or overwritten. When tapes are reused, they must be erased first, a quick job with a magnetic bulk eraser.

When a recording made on the McCoy's system is to be viewed away from the car, it has to be played on either a Hi-8 tape deck, or a Hi-8 camcorder with video and audio outputs. The form factor of the McCoy's system doesn't allow for the larger bulk of a VHS tape cassette, but the need to use the less-common (and more expensive) Hi-8 tapes is a drawback with this system.

Because there is no instant indexing to a particular segment of the tape, which is available with most of the digital systems, locating a particular segment can be a tedious process. If you have ever had to search a regular VHS

tape for a particular scene, not knowing exactly where it is on the tape, you know how time-consuming this can be.

With all that said, officers using the McCoy's system on the street found it to be as easy to use as any other. The system worked reliably, never ran down a battery while the vehicle was parked, and the officers who used it were generally satisfied with its performance. In fact, the only gripe with this system is the batteries in the remote microphone had to be replaced every few days, and officers didn't always notice they had run down until they reviewed a recording and found there was no audio. This is a limitation of any system with remotes using replaceable batteries, and is overcome when the remotes have charger cradles to restore their battery when they are not in use. This is a "no frills" system, but that is exactly what many agencies are seeking.

Mobile-Vision

<http://www.mobile-vision.com>

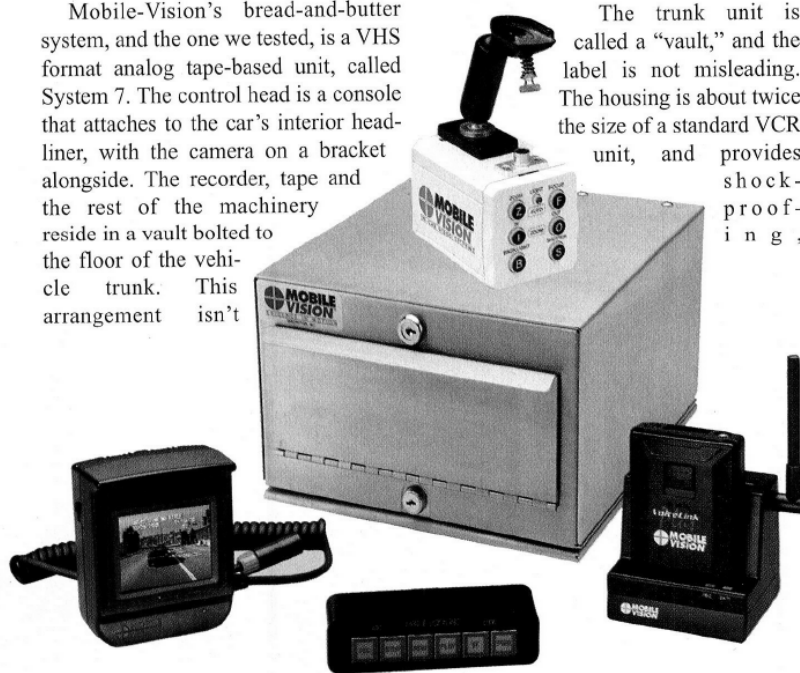
Mobile-Vision's bread-and-butter system, and the one we tested, is a VHS format analog tape-based unit, called System 7. The control head is a console that attaches to the car's interior headliner, with the camera on a bracket alongside. The recorder, tape and the rest of the machinery reside in a vault bolted to the floor of the vehicle trunk. This arrangement isn't

are about as debugged as anything is going to be.

Mobile-Vision relies on a network of its own installers and maintenance personnel. This is possible because of the volume of units it has in the field. Our system was installed by an employee of Mobile-Vision who has put in literally thousands of these systems in Michigan and its environs. It took him a little over two hours to finish the job, but that was with him talking me through the process as he went. He mentioned that he can finish installations in five to six cars a day when he gets moving along on it.

The most intimidating portion of the installation process was the routing of the power and control wire harnesses through the headliner, pillars, kick panels and back seat of the Hermiston PD 2000 model Crown Victoria. The car looked like it was being disemboweled during the install, but when he was done, there wasn't a stray wire to be seen.

The trunk unit is called a "vault," and the label is not misleading. The housing is about twice the size of a standard VCR unit, and provides shock-proofing,



especially elegant or innovative, but it does have the advantage of being street-tested. Mobile-Vision may have more units in field operation than any other patrol video manufacturer, and its experience in this area means that the units

heating and cooling to the electronics and machinery inside. Long term service in locales such as Michigan and Texas, where the temperatures can be extreme, have shown the design is effective. A base plate is bolted to the floor of the trunk, and then the vault is locked into the base plate. The entire

vault can be unlocked and removed without having to remove the base plate, and the vaults are interchangeable. A second lock on the vault controls access to the tape slot of the VCR. Retrieving or changing a tape requires only unlocking the access door, pressing the "eject" button on the VCR, and removing and/or replacing the tape.

The tapes are standard VHS cassettes, available just about anywhere. Recordings are analog and linear, meaning the tape has to be searched from front to back (or vice versa) to find the segment of interest. The vaults have been hardened to RF signals from the radio transmitter also installed in most patrol unit trunks.

Operation of the system is straightforward. The operator can start recording by pushing a "record" button on the overhead console, or by turning on the car's emergency lights or siren, or by switching on their wireless microphone within 1,000 feet or so of the vehicle. A small light on the windshield side of the console illuminates, alerting the officer to the recording, although the purpose of the light would not be evident to anyone else. An LCD monitor inside the car shows the camera view, or in playback mode, the image coming from the recorder. The soundtrack can be heard on a speaker mounted in the control console.

The wireless microphone used by Mobile-Vision is possibly the most innovative aspect of the system. The system is called VoiceLinkPlus™, and is backward-compatible with any Mobile-Vision System 7. Outwardly, the wireless mikes look much like those from other manufacturers. They are about the same size and shape as a pager, and record audio either from a lavalier corded microphone the officer can clip to a shirt or pocket flap, or from an internal microphone incorporated into the unit itself. If the lavalier microphone comes unplugged, the internal mike takes over.

Most wireless microphones are a one-way affair, where the officer can activate the recorder from outside the vehicle by turning the microphone on. VoiceLink Plus does this, but the system has two-way communication, so activating the recorder from inside the vehicle (by pushing the record button,

turning on the overhead lights, or sounding the siren) will also turn on the wireless mike. When the recorder comes on, a signal is transmitted to the wireless microphone, activating it and illuminating a discreet LCD to show the system is connected and operating (the display also shows battery and signal strength).

If the microphone is switched off while the system is still recording, the system will switch it back on after a few seconds. Officers using this system found this feature inconvenient, although they did understand the reasoning behind it. The bottom line was that the only way to turn off the wireless microphone once it was activated was to go back to the car and push the "stop" button.

The VoiceLink Plus microphones (two were supplied) run off an internal rechargeable Lithium Ion battery. Recharging occurs in the car when the system is not in use. The installation includes a charger/synchronization cradle that is wired into the car's electrical system. When the officer parks the car at the end of watch, he places the microphone unit into the cradle, and the battery charges. The cradle also communicates with the transmitter circuitry of the microphone, creating a "private channel" so transmissions from that microphone are received only by the recorder with which it is synchronized. If the unit is moved to another car, placing it in the cradle of that car will resynchronize it for the new vehicle. Mobile-Vision claims this system allows at least 10 separate vehicles to operate in close proximity to one another with no cross-channel interference.

The camera supplied with our test system was Mobile-Vision's Nite-Watch™ model, which provides for both backlit and very dimly lit environments. In a backlit situation, where the camera is pointed into the sun or some other brighter-than-normal light source, figures in the foreground can lose detail because the automatic exposure feature of most cameras will stop down the iris of the lens. When the backlight button on this camera is pressed, the iris opens, so more dimly lit subjects can be seen clearly.

In very dimly lit settings, activating the Nite-Watch feature (by pressing a

button on the back of the camera) improves light sensitivity to less than 0.03 lux (most cameras operate reliably down to about 1 lux). The effect isn't as dramatic as with infrared or light amplification hardware, but is still a huge improvement over most standard in-car cameras. Mobile-Vision's Web site has some downloadable clips made with and without the Nite-Watch feature.

Like the other systems reviewed, Mobile-Vision's System 7 has the usual bells and whistles, showing an onscreen icon when emergency lights, siren and/or brakes are applied, a user-configurable date, time and caption display, and onscreen labels showing whether one or both wireless microphones are active. The camera can be swiveled around to show a view of the back seat, or removed from the car entirely, if desired. Only one channel of video can be recorded at a time.

Management of the videotapes that will accumulate from use of the System 7 is up to the user. There is no management system supplied, although one might not be needed. The tapes will accumulate like those in most households that have VCRs, and most every agency that uses VHS tapes (and there are a bunch of them) have developed some type of tracking system to manage the inventory. If you want a VHS-based patrol video system, you probably can't go wrong with Mobile-Vision. The number of units they have deployed and the experience of the company indicate they will be around to service the units for some time to come, and the units are solid enough to survive several vehicle service life cycles.

By the time you read this, Mobile-Vision plans to have its new digital system in production. Called the Flashback™, it will use Compact Flash solid state media for recording, instead of hard drives or tapes. This plan virtually eliminates moving parts in the system. Compact Flash media are typically used in digital cameras and music players, and have capacities of 2-4 GB or more. Mobile-Vision says this will provide for two to four hours of video at 320x240 resolution. The system has inputs for two cameras, one recording at 30 frames per second, and a second (presumably rear-facing) camera recording at 5 fps. The system will have

a pre-event recording capacity of up to one minute.

The system can be placed in record mode by activation of the emergency lights, siren, a manual switch, or when an internal accelerometer detects a crash. The system will use the same two-way VoiceLink Plus wireless microphones used by the VHS system we tested. Transfer of video data is via a wireless 802.11g network, or a hard-wired serial, USB 2.0, or Ethernet interface.

Mobile-Vision is also offering a video cataloging product called the Digital In-Car Video Manager. The system provides access and management of video data from any computer on the network, allows searches based on time, date, officer name, keyword, or any other captured metadata, and will permit notes, JPEG images, or documents to be "attached" to the video. The system is scalable to provide for video from one to 1,000 or more cars.

International Police Technologies
<http://www.policetechnologies.com>

International Police Technologies' (IPT) entry into the digital patrol video market is called the VisionHawk™, and is one of two pure digital systems that we installed. There is some confusion over the label of "digital." MiniDV camcorders used in some systems record a digital signal, but the recording medium is a cassette tape that has many of the same limitations as any other tape-based system. In the discussion here, a "pure" digital system is one that records both a digital (as opposed to an analog) signal, and uses a medium that provides for random access, such as a hard drive, optical disk, or solid state memory chip. The VisionHawk records to a removable hard drive.

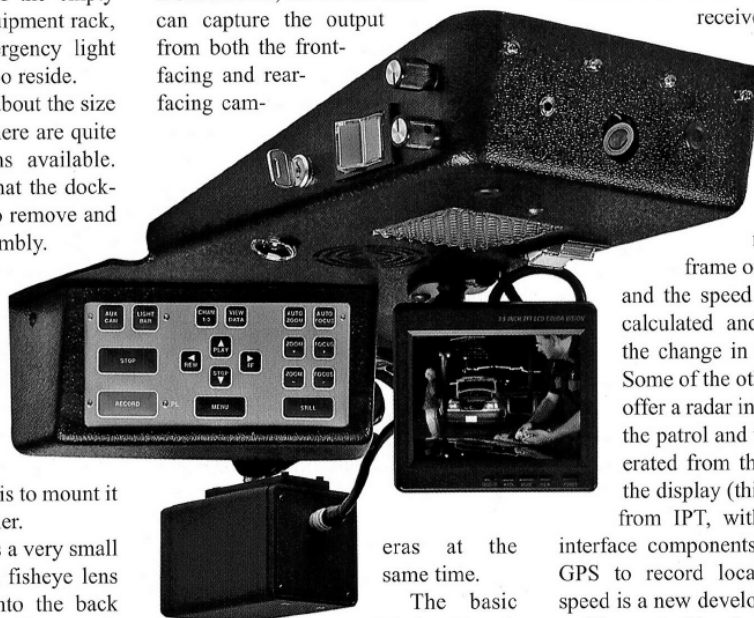
The installation was performed by IPT personnel. Because this was a temporary installation, the installers placed the mini-computer that serves as the recorder under the passenger seat, and wedged the docking station for the removable hard drive between the passenger seat and the center console. In a more permanent installation, the mini-computer would probably have gone into roughly the same place (although it can be mounted just about anywhere), and the hard drive dock would have

been installed into one of the empty slots in the patrol car's equipment rack, where the siren and emergency light control heads and radio also reside.

The docking station is about the size of a paperback book, so there are quite a few installation options available. The only requirement is that the docking station be accessible to remove and insert the hard drive assembly. Because the equipment is all located in the passenger compartment, there wasn't any need to run cabling to the trunk area. A rear seat microphone was mounted temporarily on the prisoner cage partition. The standard method is to mount it above the rear seat headliner.

The control console has a very small rear-facing camera with a fisheye lens that captures the view into the back seat. In fact, the view is wide enough that the officers seated in the front seats get a portion of their heads in the frame, as well. The rear-facing camera is

monochrome, but the recorder can capture the output from both the front-facing and rear-facing cam-



eras at the same time.

The basic VisionHawk setup includes not only the recorder, camera, control head and display, but also a GPS antenna that mounts on the

windshield and connects with a receiver mounted in the control panel.

The receiver is very small and does not impair the view. GPS coordinates are recorded on every

frame of the video image, and the speed of the vehicle is calculated and displayed on the change in GPS coordinates. Some of the other manufacturers offer a radar interface that places the patrol and target speeds generated from the traffic radar on the display (this is also available from IPT, with the appropriate

interface components), but the use of GPS to record location and vehicle speed is a new development.

The control head and monitor attach to the sun visor mounts, like in most other installations. The LCD monitor swivels, while the control panel is

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angled toward the driver. The monitor is slightly larger than those in most other models, in part to accommodate a data display that borders two edges of the camera image. The data display can be toggled on and off at the touch of a button on the control panel. The data display includes the time, date, GPS coordinates, and vehicle speed, as well as icons for emergency light, brake and siren activation. It is less critical for this information to be displayed on screen, as it is captured in a data field bound with every frame of the video signal.

Because VisionHawk is a true digital system, it allows for pre-event recording. When the video system is in operation, whether in record mode or not, the system is capturing the output of the camera (and the microphones, if activated) to a solid state memory chip. The capacity of the chip and the quality of the recording determine the duration that is maintained, but it varies from 20 seconds at the highest quality setting, to 60 seconds at CIF resolution. In prac-

tice, this feature worked flawlessly on the VisionHawk system.

Review of recorded segments in the patrol car is much easier than with the tape-based units. Each recorded segment is saved with a file name that includes an identifier for the recorder itself (typically, the vehicle number or radio callsign), and the time and date the recording began. When an officer wishes to review a recording, he brings up the file listing, and locates the segment with the appropriate time and date code. Pressing "play" with that segment selected begins the playback. There is no need to fast-forward or rewind a tape to locate the desired segment, although it might be necessary to do this to get to a desired point within a segment. While the system is playing back a file, it can continue to record. This is not possible with a tape-based system.

In the system we tested, recordings were saved to a removable hard drive, which docked with a desktop computer server that is a part of the VisionHawk package. There are also options to

offload the video files via a hard-wired Ethernet connection to the patrol car, or wirelessly via a proprietary form of an 802.11a network. In the removable hard drive configuration, officers pulled the hard drive from its dock in the patrol car and then inserted it into a similar port on the front of the desktop server. The server recognized that a new drive cartridge had been inserted, and started transferring the files to the server. This seldom took more than a few minutes, depending on the volume of files on the drive. The portable drive was then "wiped" and was ready to be re-installed in the car. In practice, this procedure would probably be handled by a supervisor or a clerk, and officers would just swap out full and empty hard drive cartridges. However, when cars are used by more than one officer, each one could have his own drive to install in the car at the start of a duty tour.

The server comes with file management software that allows someone with the appropriate security access to search, index and delete any video file.



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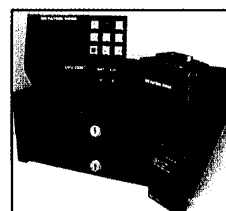
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Searches can be done by date, time, unit number or any combination of these. We didn't incorporate the server into Hermiston PD's internal local area network, but had we done so, any user would have been able to bring up video segments residing on the server from any workstation on the network. However, they would not have been able to delete or alter any of the video files. The video is recorded in a proprietary format that is viewable only by using a viewer package available from IPT (which can be distributed, royalty-free, to anyone who needs it). If a video file had to be released to an outside party, such as a prosecutor's office, all that would be required to make the video viewable is to include the viewer software on the same disk as the video clip. The software is only about 400K and fits on a CD or even a floppy disk with ample room to spare.

Another uncommon feature of the VisionHawk system is the capability of saving a single frame image at the push of a button, or at a time interval chosen by the user. An officer can push a button on the control console and save a single JPEG image to the hard drive, showing whatever was in the camera's view at that moment. The system can also be set to save a single frame image at any interval up to 30 frames per second (full-motion video is about 30 frames per second). Set at a less frequent interval, say, every five seconds, the system would create a record of everywhere the car had been for an entire duty tour, and still preserve most of the recording capacity for full motion video. This feature could exonerate (or implicate—the knife cuts both ways) an officer who was accused of “cooping” or otherwise spending his duty time in inappropriate pastimes.

All of the user-configurable features are set from the control panel while an access key is inserted and turned. No key, no changes. This includes the captions that will appear on the video display, the resolution of the recording, the frequency of still frame capture (or the disabling of this feature), and other options. The only bug we found with this system is that assigning a unit identifier with more than a few characters in it caused the file system display to stop working. Files were still saved, but

couldn't be easily reviewed in the patrol car. Truncating the unit identifier string in the setup resolved this problem. By the time you read this, IPT will have probably fixed that issue in its software. When I called IPT for technical support on this, I got a technician on the line in under a minute, and he was able to diagnose the problem and offer a solution immediately.

The few problems we encountered with the VisionHawk were either attributable to the temporary installation or to a minor software bug that has since been eliminated. During our review of the VisionHawk, IPT executed the following enhancements to the product: 1) The removable drive system is now enclosed within a solid metal housing securely attachable to or inside the console. The new drive system comes with a 36-inch cable allowing greater flex-

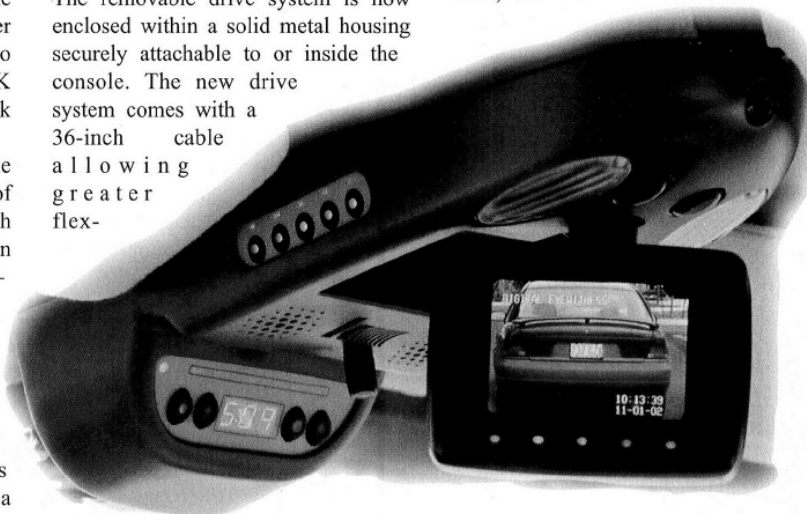
ibility in installation; 2) the four infrared emitters along the top of the overhead housing better illuminate the occupants of the car in low light conditions; 3) Improved cable design to ensure faultless use of the internal and remote microphones; 4) IPT is the only licensee for the “pre-event” recording technology.

The video output from the VisionHawk system even at the medium quality resolution, was at least as good as the typical output from a VHS recorder. IPT is a small company, but it appears to have done its homework on this system and delivered an excellent product. The only complaints from the officer who was the primary user of the system concerned the microphones. Both the remote and the internal microphone would refuse to activate for as much as half a duty tour, then would

suddenly come to life and work flawlessly. Video was recorded, but without any soundtrack. IPT interviewed the officer in depth on this issue, and presumably will have a fix for the problem by the time you read this. The VisionHawk system is otherwise a great piece of hardware and software.

Kustom Digital Eyewitness
<http://www.kustomsignals.com>

At first glance, Kustom's Digital Eyewitness unit looked a lot like a standard VHS trunk-mount system, with a control head in the passenger compartment and a recorder in the trunk. In fact, this is the configuration of the hardware, but the



internal components are very different from a VHS setup. Kustom records directly onto an optical DVD-RAM disk via a drive mounted in the trunk, and protected by a hardened, shock-resistant and climate-controlled vault. The stand-alone media storage device (MSD) option was not available at the time of testing, but it is an alternative to the vault. It mounts in the cab, saving trunk space and allowing access to the media from the passenger compartment. The MSD is now available.

The DVD-RAM media looks a little like an oversized floppy disk. It consists of a standard-size recordable DVD disk, but is encased in a hard plastic cartridge that drops into the drive and provides some extra protection and alignment for the disk. DVD-RAM disks hold about 4.7 GB of data, and are reusable once they are reformatted. The

disks sell for \$5.00 to \$15.00, depending on how many you buy and who you get them from. They are rated to last through 100,000 rewrites, or about 91 years of duty tours. Kustom makes good hardware, but I doubt if it expects any of it to last that long.

The control head unit is a little smaller than most of the others we evaluated, and has a different control design. Most of the major controls are accessed via five small raised (and illuminated) buttons on the driver's side of the ceiling mount unit. They control which camera is recording, the frequency used by the remote microphone, whether the internal microphone is on or off, whether the remote microphone can activate the recorder, and the auto-focus control. The record and stop controls are mounted on a panel just above the rear-view mirror, on either side of what at first appears to be a digital clock. The "clock" displays the amount of recording time left on the disk in the drive. A row of small labels above the "clock" display show the status of functions like the internal microphone, remote microphone activation and auto-focus. The control panel incorporates a white and red dome light.

The display is an LCD monitor on a swivel. The monitor can be dimmed or turned off completely, and also swings into a recess in the control head when not in use, where it is out of the driver's view. The monitor has five unlabeled illuminated buttons below the LCD panel. These are "dynamic controls," where the functions of each are displayed on the monitor itself. Which labels are displayed, and which functions the buttons perform, are determined by which buttons are pressed and in which order they are pressed. The rear-seat facing camera and an optional in-car mic can covertly record evidence while suspects are detained in the vehicle. This is harder to explain than to demonstrate. In use, the system is intuitive and the officers who used it learned it quickly.

The Digital Eyewitness has three recording quality settings called "good," "better" and "best." The higher the quality setting, the more data that is recorded, and the lower the capacity of the DVD-RAM disk. The lowest setting delivers 9.5 hours of recordings, the

middle 7.5 hours, and the highest quality setting five hours of recordings. Recording quality can be switched in mid-disk, as each recording segment on the disk is retained within a separate file with its own properties. Recordings are made in MPEG-I format, playable on any Windows computer with Windows Media Player (included in all Windows installations).

The quality settings also determine the length of the "pre-event" recording. Like most other digital systems, the camera is recording continually when there is power to the system, with the output going to an internal memory chip. When the system is placed in "record" mode, the contents of that chip are dumped to the DVD-RAM disk, so the events of the previous three minutes to 15 seconds are appended to the start of the recording. Because higher video quality settings require more memory and file space, a higher quality setting will result in a shorter pre-event time.

Digital Eyewitness also includes a crash sensor that places the system into record mode if accelerometers in the trunk mount unit detect an impact along any of the four sides of the vehicle. The pre-event segment is appended to this record as well, so the events in the seconds preceding the crash will be recorded.

Other optional features include Kustom's Sure Talk, a 900 Mhz transmitter that is automatically activated when the video system begins recording to ensure audio is recorded even if an officer forgets to turn on the transmitter. A built-in internal mic may be used as a cordless unit, with remote activation by the mic/transmitter.

As with other trunk mount units, there are two locks and keys governing access. One allows removal of the entire recorder vault for maintenance, and the other allows access to the drive bay to insert and remove DVD-RAM disks. Ejection of the disk is not permitted unless the eject command is enabled from the control panel, a button behind the vault door is pressed, and the eject button on the drive itself is pressed. Once the drive is open, all the user has to do is lift out the old disk and drop in a new one.

The DVD-RAM disks are readable in any Windows computer equipped

with the appropriate drive, but the system installation includes an external DVD-RAM drive that will plug into a laptop or desktop computer equipped with a USB port. Kustom does not supply any file management software with this system, so it is up to each user to determine how he will store and index the files. The setup program on the in-car recorder does provide for some basic file naming schemes, but keeping track of these will be mostly a user problem. Files can be maintained on the DVD-RAM disks like videotapes, or transferred onto the hard drive or other digital media. Because these are digital files, they can be copied an infinite number of times with no quality degradation.

Kustom supplied an external DVD drive to use for review of the disks produced by the system, one that attached to a computer via a USB port. No one at Hermiston PD could get it to work, and the DVDs were not playable on a laptop loaded with Windows Media Player. This sort of problem is common and usually due to not having the right codecs, which are files that allow the computer to translate the video into something useful. Analysis revealed that the external drive itself was faulty, and a new one was shipped immediately. This resolved the problem.

There was no video management system included with this installation at the time we tested it, but Kustom has a file management system in full swing now. The Digital Eyewitness Media Manager (DEMM) allows law enforcement agencies to easily store and manage video files recorded by the Digital Eyewitness In-car Video System. The DEMM consists of an expandable server/database and a workstation(s) with application software.

Digital Eyewitness has the usual capability to display time, date, and officer/unit information on the display, and will interface with GPS and radar units furnished by Kustom. There are inputs for the status of brakes, siren and emergency lights to show on the display and on the recording. Installation was done by a professional installer contracted by Kustom, and took about two hours, or roughly as much time as other comparable systems. Kustom has an option to record to a removable hard

drive instead of a DVD-RAM disk, but this hardware was not supplied for evaluation.

Kustom tests its video systems using HALT (Highly Accelerated Lifecycle Testing) protocols that stress the system in terms of vibration, shock, moisture and temperature extremes to ensure reliability. This system got installed just prior to one of the coldest and snowiest winters in recent history, and never wavered. We also tried to get the DVD-RAM drive to skip by driving over some potholes and speed bumps and taking some hard turns while the system was in record mode. There were no skips on playback. This appears to be a very solid system from a manufacturer with a long history of supplying quality electronics to police.

Sequent

<http://www.sequentusa.com>

Sequent is a relative newcomer to the patrol video sector, but it has a strong product. At the time this was written, its only installation was at the

Riverside (CA) Police Department in Southern California. Riverside PD has about 330 officers and 130 patrol cars. It has the Sequent system installed in 10 vehicles, with "back end" capacity sufficient to support 25 more. The system can (in theory) support any number of units, but this is the server capacity the department purchased.

Sequent's system records digital video data onto a dedicated computer and hard drive located in the vehicle's trunk. The trunk-mounted system is called the Ranger 350i. It is smaller than most other trunk-mounted units, and it's unlikely it will take up more space than you can manage. Riverside PD standardizes its patrol car electronics on a slide-out shelf that keeps them out of the way of loose equipment, but still provides ready access when needed.

Activation of the system is keyed to the lightbar, the wireless microphone on the officer's duty belt, or a dashboard mounted button. There is also a switch

available that activates the system when a shotgun is removed from its rack. Officers can turn off the wireless microphone from outside the car, and it will stay off until it is switched back on. A single camera mounted on the car headliner records in color, and has auto and manual zoom capabilities. If the officer wants to record activity in the back seat prisoner cage, he has to turn the camera around on its swivel. There is only a single channel of video under the present design, so there is no option for a second covert camera trained on the back seat.

The Sequent Ranger system has one of the lowest profile installations of any reviewed. The camera resides on a headliner bracket, there is a button and red/green status lights on the dashboard, and the monitor is a flat panel LCD that folds up into a headliner recess when not in use (which is most of the time). Everything else is in the trunk. Riverside PD uses ruggedized laptops for mobile data, and the laptop



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and video systems are not integrated at this level. Thus, the video system will work if the laptop goes down, and vice versa.

What separates Sequent from other systems is the way the video data gets from the car to the server in the police station. Riverside officers don't check out or replace removable hard drives, change tapes or DVD disks, or plug their cars into an Ethernet port when they come into the station. They park the cars in their motor pool lot, and a 2.4 GHz Wi-Fi access point (one of three at Riverside PD) senses the presence of the car. The system queries the car's server to see if there is video data to offload, and if the data is present, the files are downloaded wirelessly to an assembly server located in a room adjacent to the motor pool. If the download is interrupted by the car moving out of range again, it just resumes when the car comes back again.

Riverside estimates they generate about two hours of video per car per day, and that data is dumped to the assembly server in five to 10 minutes

under normal circumstances. It's very seldom that a car is idle in the lot for less than 10 minutes with shift changes and such, so this provides more than ample time to get the data downloaded. Once the video files have been transferred and verified, the assembly server tells the mobile unit to delete the files from its hard drive.

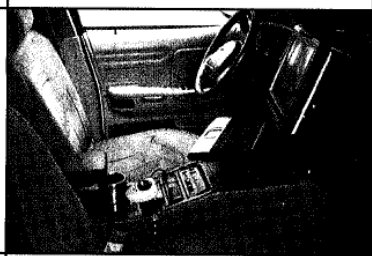
Detractors of the wireless network approach to getting the video out of the car and into the station say this method is inherently not secure because wireless networks can be hacked too easily. There is also a commonly held belief that there is just too much data to transfer smoothly via a wireless LAN. Sgt. Jim Walters at Riverside PD maintains that the process is smooth and requires no intervention by the officer, and that it has yet to lose



any
video.

Sequent uses a leading-edge compression technology that keeps the file sizes small. The system itself is secured with a number of encryption safeguards, so anyone with their sights set on cracking the LAN would have to be very good indeed to get in. There is also the question of "worst case scenario." If the LAN was compromised, the crackers would get some video files, most of which would be inconsequential, and one that depict-

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ed something of real interest would be discoverable, anyway.

The destination of the video files is called an assembly server because it does more than just receive the video data files. When a recorded incident spans more than five minutes (which is common), the system opens a new video file, verifies that data is being written to it, then closes the previous file. The result is that the server in the car will contain many five-minute files instead of one file for each incident. The purpose of this is to facilitate wireless downloading, as it's easier and more reliable to send several small files over a network than it is to send one huge one (this is why data is sent over the Internet in packets, instead of in one continuous stream). When the files reach the assembly server, the server strings the files together to create a video data file that spans the entire incident or recording. At the same time, metadata from the department's CAD system is mated with the video stream so the file can be indexed by time, date, officer ID, unit number, CAD event number, or other details.

The assembly server passes the extended file to a RAID array that is integrated with the department's LAN. About two months of video files are kept on the LAN, after which the files are archived to a video "jukebox" server loaded with DVD disks. Retrieval of the DVD files takes about 45 seconds, where retrieval of the files stored on the RAID server is almost instantaneous.

Video is recorded in MPEG-4 format, which is not quite as good as a standard VHS recording. However, when viewed on a computer monitor, I doubt if many people would notice any appreciable difference between this and most other video programs. The image, when played at nearly full screen, is not pixelated at all and the motion is not jerky. Unless there was some need or desire to blow up some small portion of a frame to a very high magnification (and patrol video was never intended to be used that way), this would serve most agencies' needs well.

Of course, there is also the added benefit of being able to retrieve and view video from any department computer terminal. That is a major benefit of digital systems with a "back end"

administrative program. Sequent's program integrates each video file with information from the CAD system, including incident numbers, officer names, unit numbers, types of incidents (e.g., accidents, pursuits, drunk driving arrests, etc.), etc. The system has the capacity to link 100 different data items to each frame of video, so there is ample room for just about any specialized application an agency might desire.

Sgt. Walters was asked if he would want to be able to deploy the Sequent system to all cars. His answer: "Absolutely." Sequent's system represents a significantly lower demand on the people who use it. Officers don't have to log removable drives, tapes, or DVDs in and out of their cars—the system takes care of that for them by sending the video data over the air. Even though there are detractors that say it couldn't be done, Sequent is routinely transferring an hour of video from cars to the server, wirelessly, in under five minutes. The system demands some big-time server capacity, but Sequent offers packages with from two to eight terabytes storage. With Sequent's compression technology, that would allow for nine months' worth of video immediately available online (plus however much was stored on DVD carousels, retrievable in 45 seconds) for a department with 15 cars in service. Riverside PD puts some unusual demands on its equipment, but Sequent seems up to the challenge.

Coban

<http://www.cobantech.com>

Coban is sometimes referred to in the patrol video industry as "the IBM system" because of its close partnership with IBM, but Coban is a company completely independent of IBM. It has two major installations, one at the Texas Department of Public Safety (primarily a highway patrol agency), and the other at the Yakima, WA, Police Department. We checked out the Yakima site for this article.

Tom Lilly is the information systems manager for Yakima PD, and his duties include keeping the patrol video system running. He is completely sold on the Coban system. When he has requested some minor change to the database or some other revision, his request is often

responded to within 24 hours, and the new code uploaded onto the Yakima PD server over a telephone line before the next business day. The company has been highly responsive to his needs and requests.

Coban's system uses 40 GB removable hard drives, each a bit smaller than a videotape cassette. Officers beginning a patrol shift go to a rack of drives and enter their ID numbers and passwords. A drive is then electronically signed out to them, and the officer physically removes the drive from the rack and carries it to the patrol car. There, it is inserted into a port between the front seats, and remains for the duration of the shift. At the end of the work day, the officer reverses the process and the drive is signed back in. Video and other data stored on the drive are transferred to a server that resides in Lilly's office. The video is immediately available to anyone with the appropriate user privileges on the police department's internal network.

The RAID array is set to keep about 20% of its capacity available for temporary files and overhead. The data is backed up onto tape each evening for redundancy. There is a plan to upgrade the hard drive storage to 8 terabytes, which will provide three years of video available on demand. Because the tape library can be expanded almost infinitely by adding additional carousels, there is almost no limit to the video available online.

The removable drives are not blank when they are checked out. Lilly loads anti-virus signature updates, the latest version of their mug shot file, and other timely data onto the drives, so each mobile computer has the most recent loadout each time a patrol shift begins.

Lilly indicated that Yakima's previous VHS-based system produced 7200 VHS cassettes a year, all of which had to be cataloged and maintained. Users can now search on any number of criteria to locate a particular video clip, where the previous system required a clerk to retrieve the cassette for the day of interest, and manually search the tape for the desired clip.

The Yakima installation interfaces with its CAD software, a product of Hitech Systems. At the time of the site visit, the API between Hitech and the

Coban system was still being written, so officers had to enter case numbers into their mobile computers manually in order to associate a video clip with a particular case number.

In the car, the Coban system has both front and rear-facing cameras, although only one at a time can be recording. The mobile computer mounted in the car serves as both the control head and the monitor for the system, and connects to the removable hard drive unit. Most video controls can be managed from a touchscreen on the monitor. On the day we visited, Yakima was undergoing a cold snap that had resulted in heavy snowfall and unusual-

and the microphone vibrates to alert the officer. This is doubly important in Washington, where there is a statutory requirement to advise citizens that they are being recorded on audio and video. Each officer is issued a wireless microphone and charger as a part of his safety equipment.

Prior to each shift, the officer synchronizes his microphone with the Coban system in his assigned car, so there is no crosstalk between systems. Recordings are in stereo, with one channel containing the output from the wireless microphone, and the other the in-car microphone. This is handy when reviewing recordings, as the car radio

to shoot the suspect, there were accusations of "execution" and similar misconduct on the part of the police. A playback of the recording revealed that officers had repeatedly pleaded with the suspect to put down the knife and surrender, and that he was shot only after an extended dialogue and when he lunged at the officer.

Yakima PD has its officers exchange the hard drives at the end of every patrol shift, but the capacity of the hard drives is not the operative issue. Each drive will hold about 60 hours of the MPEG-1 or 30 hours of MPEG-2 files that the system creates, and officers typically record two hours or less of video on a shift. The system can encode MPEG-4 video real-time for wireless video transmission back to a central office if the wireless infrastructure is available. The compression routine used on the system includes encryption and code that determines if the video clip has been altered or tampered with in any way. The video recordings are played back on Windows Media Player or any other off-the-shelf video client.

After the Yakima deployment Coban added wired and wireless video upload capability to the system in addition to the removable hard disk methodology. For example, a department can choose wireless as the primary upload mechanism to transfer the videos from the in-car unit to central storage, but use removable hard disks as a backup method in case the wireless network is down.

Video Systems Plus
<http://www.videosystemsplus.com/>

Video Systems Plus has two models in its patrol video line. The first product we evaluated is called the "Dashboard Partner System." This is a cost effective approach to vehicle installation. The Dashboard Partner System consists of a Sony Digital 8 camcorder attached to a dashboard bracket that is held in place by suction cups that adhere to the inner windshield and a support bracket that attaches to the vehicle dash. There is a dashboard control panel for the basic functions of the camera. Wireless microphones from Nady transmit the audio from the officer outside the car to the camcorder.

The patrol sergeant who evaluated



ly low temperatures. No video system had failed due to the cold, although the PD's officers were finding it difficult to get some of their cars started.

Coban has a programmable pre-event buffering. A touchscreen button allows for an officer to zoom in on a license plate and then have the camera return to the normal wide perspective view with no further intervention. The wireless microphone worn by the officer has no lavalier extension that clips on the shirt or elsewhere. A microphone on the belt unit itself picks up the audio, and every spoken word was clear on the recordings we reviewed.

Communication between the wireless microphone and the recorder is bi-directional. If the recorder is activated while the officer is out of the car, an LED on the microphone box comes on,

can often cover dialogue that would otherwise be picked up by the wireless mike. By switching to just the channel from the wireless microphone, this problem is avoided.

The officer can also put the system into record mode by switching on his microphone. This feature proved invaluable in an officer-involved shooting not long before our visit. Yakima officers responded out of the city limits to assist the county sheriff's department with an individual who was threatening deputies with a knife. The cars were too far away and pointed in the wrong direction to capture the altercation between the officers and the suspect, but one officer did have the presence of mind to turn on his belt microphone and record the audio portion of the confrontation. When an officer was forced

this unit was largely satisfied with its performance. He said the audio transmitted from the wireless mike was "clear as a bell" even though there is no lavalier microphone extension from the transmitter. The unit is placed into record mode by any of several means: manual activation from the control panel, lightbar activation, or powering on the wireless microphone/transmitter from outside the car. The unit takes about five seconds to power up and begins to record after the activation command.

Because this is a tape-based system, there is no pre-event recording. Digital 8 is a digital, tape-based format, and it has the drawbacks of an analog system in that there is no random access to a specific recording. However, the digital recording format of the system allows for transfer of recorded material through USB and IEEE1394 ports on the camera. Required software for data transfer is provided with each system. In order to review an incident in the car or outside, the user needs to fast-forward and rewind the tape until the desired clip is reached, unless the



recorded data has been transferred to a computer. There is also more limited information recorded in the viewer window. Most other systems allow the user to place information such as the department, unit number, siren and emergency light status, etc., in the frame. The Dashboard Partner System is limited to only recording the data/time informa-

tion and a 20-character title where officer name/unit number information can be placed.

The mount supplied with the unit is sturdy and allows the camera to be removed quickly, where it will run on its internal battery. This allows the camera to be used outside of the car if desired, a feature not available with the other more permanently mounted units. The camera's internal battery charges while mounted on the dashboard anchor, so it should almost always have a full charge.

The unit has a "NightShot®" feature that allows the camera to function in very low light conditions. This is accomplished by lengthening the shutter speed so as to allow more light to reach the camera sensor on each frame. The

installer tested this feature in a closed garage with very little ambient light and reported that it did an excellent job of recording detail.

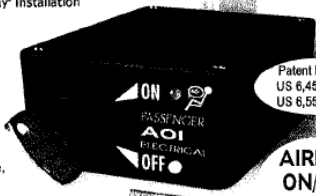
Because the tape loads from the bottom of the camera, the camera has to be removed from its bracket in order to change tapes. Each tape will record one to one and one-half hours of video, depending on speed/quality settings. The Digital 8 tapes are available nearly everywhere that film and electronic supplies are sold, including most department/variety stores. Unlike the smaller VHS-C system, there is no adapter that will allow a Digital 8 cassette to be played in a VHS machine.

While the design of the Dashboard Partner has the advantage of being removable from the car to be used remotely, it also leaves the electronics exposed to direct sunlight and heat, which can degrade the unit over time. Use of the provided thermal cover when the system is not in use for extended periods will minimize this exposure.

The other Video Systems Plus unit evaluated by *LAW and ORDER* is called the PAVE (Police Audio Video Equipment). PAVE has a modular design with a camera and monitor/con-

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US 6,452,488B1
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trol pad unit mounted on the sun visor bracket, and the recorder underneath the passenger seat or otherwise elsewhere in the passenger compartment. The officer who tested this unit was generally satisfied with its performance, but said there was about a five-second delay between the time he would activate the recorder and when the recording actually started.

PAVE uses a standard VHS cassette recorder, although it is not integrated with the camera as is the Dashboard Partner. The VHS medium is still tape, as opposed to a random access digital format. The tape-based format precludes the availability of pre-event recording. PAVE does provide for some "labeling" of the video image with unit number, microphone status, lights and siren status, as well as radar information. A digital version of the PAVE System is under development but was not available for review. This system will offer a drop-in digital recorder replacement for the VHS VCR providing for initial purchase of a lower cost analog system with the option to upgrade to digital at a later date.

PAVE has an auto-zoom feature where a single button press zooms the camera in on a predesignated spot, then zooms back out again after five seconds. The idea here is to ensure that the license plate on a stopped vehicle will be captured clearly without a lot of intervention on the part of the officer.

Both the PAVE and Dashboard Partner were very easy to install. The systems are a fraction of the cost of other units and are a good solution for a department with a tight budget.

Decatur Gemini Video System

<http://www.decaturradar.com>

Decatur is best known as a traffic radar company, but it does have a single in-car video product called the Gemini Plus. The Gemini Plus, is a Hi-8 tape-based unit that mounts onto the headliner of the patrol car. There is no equipment installed in the trunk or elsewhere in the vehicle, as the recorder, camera and control head are all part of a single module. The unit installs quickly and can be moved from one car to another without major alterations to the interior.

Hi-8 recordings produce 400 lines of resolution, considerably beyond that of most digital systems. However, this is a tape-based system, and subject to the same mechanical limitations of a VHS system in that the system cannot continue to record while a clip is being reviewed, and some rewinding and fast-forwarding is usually necessary to locate the precise position desired on the tape. There is also no pre-event recording.

Decatur produced this system to make it easy to install without giving up any room in the passenger compartment. The Gemini system is one of the easiest to install, as the entire unit attaches to the headliner via the windshield visor and dome light mount screws. The system builds the Hi-8 tape deck, monitor, controls and camera into a single unit, so there's nothing to install between or under the seats, on the dashboard, or in the trunk. In fact, the only wiring an installer needs to route are the connections for power and to the sensors for the overhead emergency lights and brakes.

The Hi-8 cassettes this system uses are a bit larger than the mini-cassettes used for pocket tape recorders. Each tape will hold between two and four hours of video, depending on the speed setting. Setting the tape for the slower speed degrades the video image somewhat. The tape resides in a lockable

compartment, and there is a safeguard circuit to prevent erasing or recording over a segment of tape that has already been recorded. The same lockable compartment provides (and prevents) access to switches that permit changing of some user options and the text, time and date blocks that appear on the video image.

The system was installed so it would shut off whenever the vehicle ignition was turned off, which meant the system had to be restarted every time the ignition was turned on. This was done so the system wouldn't draw down the car's battery if the system was not turned off manually. Powering up took only a few seconds, and there is a series of tones that sounds when the system starts, which users might find reassuring or annoying.

Once the system is powered up, it takes about five seconds after hitting the "record" button before the recording actually starts. If the user was reviewing a previously recorded segment when the system is put into "record" mode, there will be a greater delay while the tape deck advances the tape to the first unrecorded portion. If the proper connections are made, the system will also go into record mode when the car's overhead lights are turned on, or when the user turns on his wireless microphone in range of the unit. This is a one-way action, as the system will continue to record without audio if the microphone is turned off again. The only way to stop the recording is to push the "stop" button on the control console.

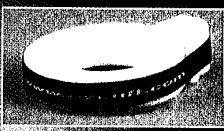
Reviewing recorded segments is as easy as pushing the "rewind" button and watching as the recording plays back-



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ward at an accelerated speed. When the segment of interest is reached, releasing the "rewind" button will start that segment playing forward. On the model that was tested, there was a "play" button, but it had no apparent function.

Resolution of the video is approximately the quality of a VHS recording, and is in analog format. If the recordings are to be played in court, it will require the purchase of a Hi-8 player, as these cassettes are not compatible with typical consumer-grade video appliances. An alternative would be a consumer-grade Hi-8 handheld camcorder, as most of these have composite video outputs that will plug into a conventional VCR or television. If tapes are reused, they will have to be erased with a bulk tape eraser.

The control panel has a "wide" and a "tele" button. Respectively, these cause the field of view to pull back or to zoom in and remain there until the camera is reset. There is also an "auto" button that zooms in for about five seconds then returns to its previous setting. This is intended to focus on a license plate at nearly full screen before returning to the full-scan normal view. The camera also has a "night" button that opens the camera's iris to allow more light to enter in low-light situations.

The Decatur Gemini system has a single camera and a single channel of video. If the user wants to record activity in the back seat, the camera needs to be manually turned to the rear.

The officer who was field-testing this product sample had no previous experience with a patrol video system, and he was ecstatic about the performance of the Gemini.

Decatur does have a new digital in-car video system, called the Gemini Digital. For more information, contact the company at www.decaturredar.com.

ICOP Digital, Inc.
<http://www.icopdigital.com>

The *ICOP Model 20/20™* digital in-car video system is a product of ICOP Digital, Inc., founded by Mr. Bud Ross, the founder and former CEO of Kustom Signals. We weren't able to get a system to test, so we can't speak to the reliability or user-friendliness of this system, but ICOP Digital certainly gets the highest marks for inventiveness. ICOP Digital, Inc. will begin shipping units in August 2004.

The *ICOP Model 20/20* is a truly innovative design, as there is *nothing in the trunk* – the entire system fits in the dash. This is an extremely important feature, as it not only makes the system very simple to install and service; it also presents no danger to the officer in the event of an accident. Also important is the fact that the most stable location in a vehicle is the dash, which is the location of the *ICOP Model 20/20*.

The *ICOP Model 20/20* replaces the AM-FM radio in the dash of the police vehicle. Before you dismiss this idea of likely to incite dissension in the ranks from your dittoheads and news/sports addicts, the unit also includes an AM-FM radio. It provides up to 60 seconds of pre-event recording (with two cameras recording simultaneously). The *ICOP Model 20/20* dash unit includes the monitor (3.8" TFT "Sunview" monitor with brightness adjustment) and all of the control switches. The control

panel is backlit, with LED indicator lights and brightness adjustment.

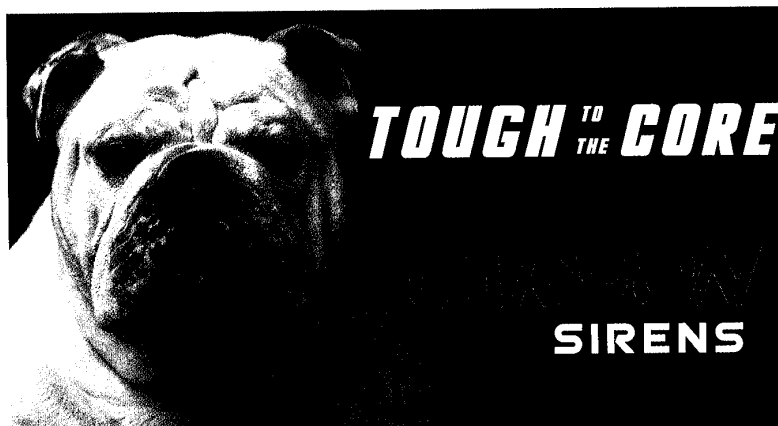
A password-protected flip-down panel conceals a removable hard drive, with capacity up to 20 GB (high resolution *full* VGA – 640 x 480). The removable hard drive is carried into the station to download the video onto a PC or server through the use of a special hard drive docking station. This vehicle grade hard drive can store 8 - 10 hours of high resolution recording time. The unit comes standard with a color Sony® camera (10x optical zoom / 40x digital zoom) for recording out the front windshield, and one low-light compact rear seat wide-angle camera (also, a third camera, a color Sony camera, is an available option). The *ICOP Model 20/20* can record two cameras simultaneously.

A GPS receiver is also standard, built into the unit, and records the GPS coordinates with every frame of video. The *ICOP Model 20/20* has a "Mark" button feature that marks video frames for instant recall of "GPS" locations for capturing such events as contraband being discarded from a vehicle.

The *ICOP Model 20/20* comes standard with a 900 MHz wireless transmitter, which is worn by the officer (18 hours of battery life in *Standby*, and 10 hours of battery life in *Transmit*). It records the audio outside of the vehicle (the system also includes an in-car audio recorder). This wireless transmitter has an emergency button that, when pressed, transmits a distress message (synthesized voice) to police headquarters, noting the officer's GPS coordinates and officer ID. The transmitter is also able to remotely start the recorder, within a range of 1,000 feet.

There are interfaces to embed traffic radar, speedometer, emergency lights, brakes, siren, and GPS. The unit also notes the time, date, officer ID, and vehicle ID information on the display. Software on the Digital Video Recorder (DVR) unit is easily upgraded using a laptop computer, through the USB port on the DVR. The *ICOP Model 20/20* temperature operating range is -20° C (-4° F) to 70° C (158° F).

The *ICOP Model 20/20* allows the officer to enter event classification codes, for easy search and retrieval of files. The video files are convertible to



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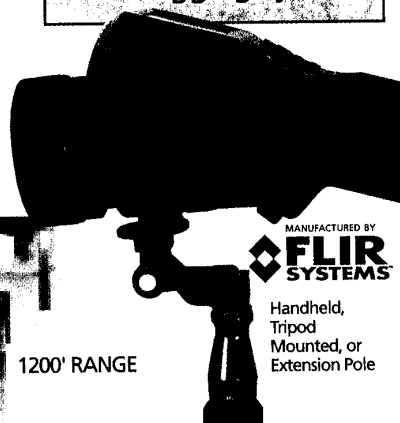
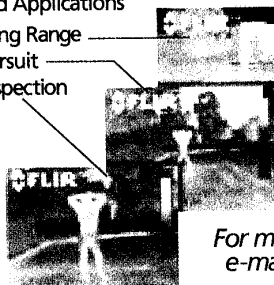
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either Windows Media Player® or MPEG-2® format. The *ICOP Model 20/20* system uses proprietary software, which enables efficient storage, data management, and saving of files onto a PC, server, DVD, CD, or VHS tape. More importantly, this proprietary software prevents unauthorized access and editing of the files, affording secure tamper-proof files.

The *ICOP Model 20/20* holds the record for simple installation and servicing (no holes to drill – just plug and play, in less than an hour). Bud Ross, founder and CEO of ICOP Digital stated “Police departments should avoid the dangers of locating hardware in the trunk. ICOP Digital is proud that our company has developed a system which makes this possible, offering law enforcement the state-of-the-art in-car digital video system. We believe it is also very important to note that because the *ICOP Model 20/20* is totally installed in the dash, it is not an injury threat to the officer in the event of an accident.”

Martel Electronics
<http://www.marteldirect.com>

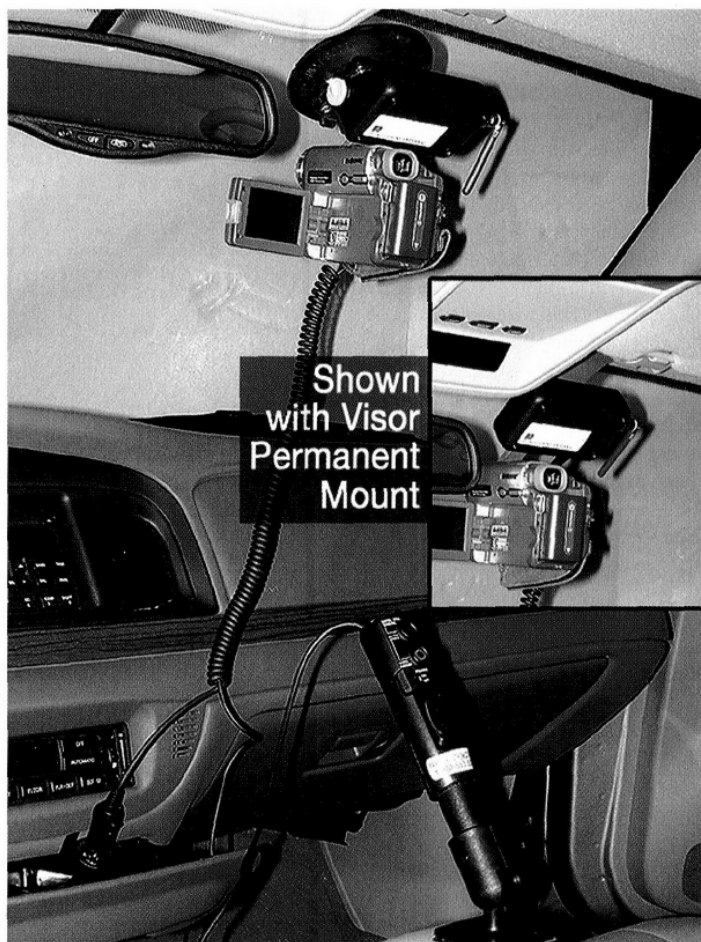
Martel Electronics has four patrol video systems that adapt camcorders to dashboard and windshield mounts, as well as the Video Marshal, a permanent mount system that places the 8mm VCR component inside the glove compartment, and My Digital Partner, a unit that Martel characterizes as “the world’s smallest 2 in 1 system.” These are among the most economical systems in the industry, ranging in price from about \$1,500 to \$2,500.

The Dash-Hound and My Video

Partner are essentially the same system (and the same price), with different camera mounting brackets. Both use a Sony Hi-8 camcorder mounted above the dashboard. The Dash-Hound mounts the camera lower and closer to the dash, and does provide 360° of panning of the camera. The rigid front-only

view is the only one available. The My Video Partner uses a different mounting bracket that places the camera higher, but allows the camera to be swiveled 360° to view the scene to the side or to record activity in the prisoner cage or passenger seat. Both units allow for removal of the camera for use external to the patrol car, if desired. The system includes two wireless microphones with a 1,500-foot range, a cigarette lighter power cord, and a remote activation button.

Neither of these units provides for any labeling of the video frame beyond time and date. Martel does highlight the design of its 800 MHz wireless microphones, which has 16 independent channels so 16 officers can arrive on the same scene and won’t interfere with each other. Its wireless systems also come with cell phone-style drop-in intelligent chargers for recharging the wireless microphones. The units are



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contained in a belt-carried box that does not use a separate lavalier microphone clipped to the shirt or elsewhere. These microphones are reported to be sensitive enough to pick up conversations between the officer and subject clearly enough without the need for an external wired microphone.

My Digital Partner is a similar design, using a windshield-mount Sony MiniDV camcorder with a small touch-screen control pad integrated with the mount. The camera is controlled from either a wired remote control pad or linked to activation of the patrol car's emergency lights. MiniDV recordings are extremely high quality, with more than 500 lines of resolution. The camera used by the My Digital Partner will also record onto solid state Memory Stick media, and has the capability of saving still frames onto the Memory Stick or the tape. The MiniDV format also provides for more variety in titling the video frame beyond time and date.

My Digital Partner, like the Dash-Hound and My Video Partner, can be removed from the car for external use as a camcorder, then returned to its bracket without the need for tools. The camera will swivel 360° in its mount for recording of events outside the normal straight-ahead field of view, and has an optical zoom of 10X available.

MiniDV is a way to have some of the benefits of a digital system without investing in the more expensive digital hardware. Recordings can be transferred via USB or IEEE 1394 (what Sony calls iLink®) cable to a computer medium, either DVD, CD or hard disk, and subsequent transfers will not degrade as with analog. However, because this is a tape-based medium, pre-event recording is not available.

The last system in the Martel line is the Video Marshal. This is a Hi-8 recorder and camera that does not rely on a recorder module in the trunk or under a seat. Instead, all the works are built into the control head, which includes the control panel and an LCD monitor. The control head/recorder/monitor unit can be mounted on the headliner, in a vertical stack of patrol car electronics on the dashboard, or in the center console. The most conventional installation would be on the headliner. The camera is mount-

ed below the windshield bracket and can be swiveled 360° at will. Video can be reviewed in the car on the included monitor and with sound from an integrated speaker.

The control panel buttons are backlit in blue for nighttime operation and to produce as little glare as possible. All controls are on the console, where some other systems place zoom and low light controls on the back of the camera. The camera operates to a level of 1.0 lux with 480 lines of horizontal resolution. The Hi-8 tape cassette is carried in a locked compartment so it can be removed or installed only by authorized personnel. The unit also has a rear seat microphone for recording suspects.

Martel offers a free 30-day trial of its systems, so long as the request is made on law enforcement agency letterhead. It may be the lowest cost system of any that we tested, and is only one of two systems that is easily moved from one car to another, or able to be used out of the car entirely.

Tim Dees is a former officer who writes and consults about applications of technology in law enforcement. He can be reached at (509) 585-6704 or by e-mail at tim@timdees.com.

Companies not included in the Video Patrol article

Digital Safety Technologies
556 Metroplex Dr.
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www.digitalsafetytech.com

MPH Industries, Inc.
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www.mphindustries.com

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www.digatronsecurity.com

Northland Security Products
2419 12th Ave South
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www.mobileeye.com

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Safety Vision Announces Acquisition of OPV and Entry into Police Video Market

Houston, TX, June 4, 2004- Safety Vision is pleased to announce its entry into the law enforcement mobile video industry with its asset purchase of On Patrol Video (OPV) out of Ontario, OH. "It's a tongue-and-groove fit," explains Bruce Smith, President & CEO of Safety Vision, "when you consider the close match-up of products offered and industries served." For nearly a dozen years, Safety Vision has provided total mobile video solutions, including rear- and side-vision cameras as well as analog and digital recording systems. They enjoy a solid standing in public-service industries, most notably in fire and government fleets. And OPV had been providing police departments with in-car video systems for about 15 years. Says Smith, "OPV's rugged yet officer-friendly systems have consistently won points for reliability and ease of installation. With our acquisition of these desirable assets, Safety Vision now offers unmatched breadth and professionalism in the mobile vision marketplace." Safety Vision is the largest manufacturer and distributor of mobile vision and surveillance equipment in North America. Contact 1-800-880-8855 or visit www.safetyvision.com.

Contact: Chris Portillo,
Marketing Director
Safety Vision, L.P.
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Glossary for Patrol Video

802.11x also known as Wi-Fi, a wireless network where devices communicate via radio transceivers instead of through cables. The "x" is a letter (a, b or g) that indicates the particular flavor of Wi-Fi, each having different bandwidths and security features.

AIT Advanced Intelligent Tape, a magnetic tape storage system developed by Sony. AIT cassettes can hold up to 100 GB of data.

API Application Program Interface, a set of routines, protocols and tools for building software so it will work properly and reliably with other software.

byte 8 bits, each bit being a one or a zero. A string of eight ones or zeroes represents one character in a document, or a state of one pixel in an image. It might require many bytes to describe the color, brightness, position or other characteristics of a pixel.

CAD Computer Aided Dispatch

CD-ROM Compact Disk-Read Only Memory, otherwise known as a CD. CDs have a capacity of about 700 MB or 0.7 GB. Variants are CD-Rs and CD-RWs, disks which are recordable. The former can only be recorded once, where a CD-RW can be erased and used for another recording.

CIF Common Intermediate Format, a standard for video similar to MPEG-1. Quarter CIF contains ¼ as much data, and is used for video streams sent over telephone lines.

DVD Digital Video Disc or Digital Versatile Disk. DVDs resemble CD-ROMs, but they have a capacity of at least 4.7 GB or almost seven times the capacity of a CD.

Ethernet A commonly used network technology used to link together computers and other devices and share resources between them.

GB Gigabyte, or 1024 Megabytes/MB

KB Kilobyte, or 1024 Bytes

MB Megabyte, or 1024 Kilobytes/KB

metadata data about data. Metadata is usually attached or otherwise associated with each element of data in a system, and describes the data or information about the data. Metadata in a digital photograph might include the time and data it was taken, the shutter speed and f-stop, whether a flash was used, etc. In the video environment, it might include the unit number of the recorder that made the recording, the time and date, whether the vehicle was moving or not, GPS coordinates, etc.

miniDV a true digital video format, although one based

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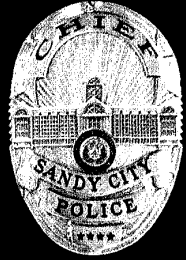
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on tape cassettes. MiniDV recordings are at 720x480 pixels, or roughly the same used in commercial DVD recordings.

MPEG A video file standard created by the Motion Picture Experts Group, from which comes the acronym. MPEG files are designated by a suffix number, e.g.

MPEG-1 Video with a resolution of 352x240 pixels at 30 frames per second (fps). This is slightly inferior to the video image from a VHS recording.

MPEG-2 720x480 and 1280x720 pixel resolution at 60 fps, with very high quality sound. This is the standard used for video encoded on commercial DVD disks.

MPEG-4 Similar to MPEG-1 in resolution, but uses a compression algorithm that results in much smaller file sizes.

pixel A single element of a digital image. These pixels or dots vary in color, brightness, saturation and other characteristics to make a lifelike picture.

RAID Redundant Array of Independent (or Inexpensive) Disks. RAID arrays are used to ensure that online data is not lost and can be retrieved quickly. RAID arrays are usually described with a number, e.g.,

RAID 0 The data is "striped" or divided between two or more disks for better performance. Writes and retrieves of the data move faster, but the data can be lost if any one of the disks in the RAID 0 array fails.

RAID 1 The data is copied to two disks simultaneously for redundancy. No speed or performance advantage, but the

data is twice as secure from hardware failures. The "belt and suspenders" approach.

RAID 3 Like RAID 0, but with one disk reserved for error correction. Speedy and with better security than RAID 0.

RAID 5 Combines the features of RAID 1 and 3. Excellent performance and good data security

resolution the number of pixels or dots that make up the full area of an image. It is usually expressed as the number of pixels horizontally and vertically, e.g., 640x480, 1280x768, etc. As these numbers increase, the image will appear less grainy and more lifelike, and can be enlarged to a bigger size without loss of detail. Large resolutions greatly inflate the size of the file that contains their information. A 640x480 image contains four times as many pixels as a 320x240 image.

RMS Records Management System

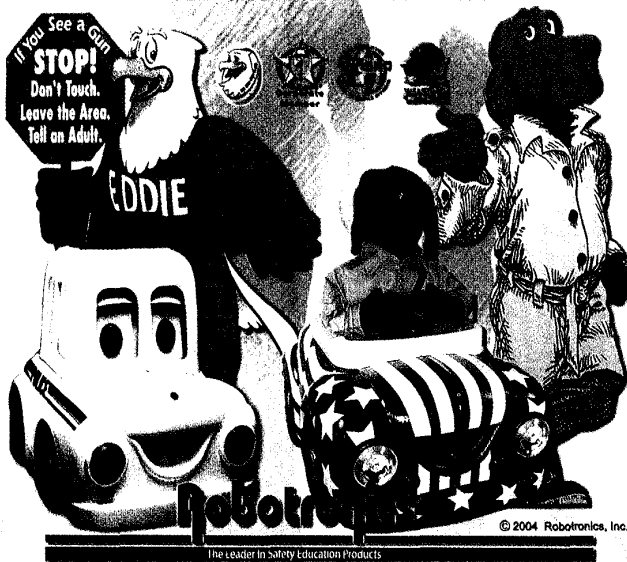
SCSI Small Computer System Interface, a high-speed interface commonly used for hard drives under heavy use and demand configurations.

terabyte 1024 Gigabytes. This would be the capacity needed to store about 200 full-length DVD movies, with added features, multiple soundtracks and coming attractions.

VHS Video Home System, the standard for consumer video recording and cassette movie distribution.

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▼ Firearms and Training Issues for Police Cyclists

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