Digital In-Car Video Recording and Management System

Purpose:

Research the feasibility of obtaining digital in-car video systems to include functionality, cost, and the availability of grant money.

Methodology:

1. Send out an email to the Florida Police Accreditation Coalition (FLA-PAC) soliciting information on digital in-car video systems utilized by other agencies.

2. Send out an email to the International Association of Law Enforcement Planners (IALEP) soliciting information on digital in-car video systems utilized by other agencies.

3. Contact agencies using a digital in-car video system in order to identify problems they may have had with its implementation.

4. Evaluate available digital in-car video systems offered by the various venders.

5. Have agency members currently using an analog in-car video system evaluate the digital systems.

6. Have Information Services evaluate the digital in-car video systems to determine compatibility with our current computer network and identify hardware necessary to manage the data.

7. Identify funding sources for the purchase of digital in-car video systems.

Significant Findings:

1. Panasonic's Arbitrator is not on State Contract and Bill Salveson could not give a cost estimate for the system. When contacted two months later, Panasonic could not provide an accurate cost, but provided a cost basis of "less than $8400.00" for the camera system only. The price did not include the management system or the storage memory.

2. Custody's system is the least expensive of the systems evaluated. However, their system is not in production and they do not have an operational system for evaluation.

3. Watch Guard's system records video directly to a Digital Versatile Disk (DVD), eliminating the need to electronically store the data. However, they did not have an operational system to evaluate. Watch Guard is just beginning production of a prototype.

4. Decatur's system records to an internal Hard Disk Drive (HDD), which uses a docking station for uploads to an electronic storage system. Decatur's system is the only one to have a touch screen and meet ISO standards. Its design and installation is the same

1

as the analog version, which Gainesville Police Department (GPD) has in operation. This system was preferred by Officers. Quotes were provided (number of cameras - 4, 5, 6, 10, and 40) for several system configurations, with the six system configuration being most economical at $40,929.00. This configuration is for six complete systems, including cameras, computer hardware and software, minimal storage, and docking station.

5. Cruise Cam offered three (3) system configurations and is mounted on the passenger seat. Its design and installation are the same as the analog version, which GPD is currently phasing out of operation. The camera mounting requires cutting the passenger seat.

6. When the FLA-PAC & IALEP were solicited for digital in-car video camera feedback from its members, five (5) agencies responded. All five agencies are currently using the Kustom camera. Kustom Signals presented their system, but did not bring one for evaluation during the vendor's presentation.

7. Members at GPD who currently use an analog in-car video system were asked to evaluate Panasonic's Arbitrator and Decatur's Gemini and rate 11 attributes. These officers gave Decatur a better rating over the Panasonic system.

8. During a meeting with Dave Duda, Information Services, he addressed three concerns. The first concern is the security of wireless data transfer. Unless the data is secured, it has the potential to be captured by unauthorized persons. The second concern is the speed at which wireless data is transferred, which may cause delays. The last concern is the separation and security of the data from the agency's existing network. The current network cannot support the additional storage requirements and would slow system access throughout the network.

Recommendations:

1. Search for funding sources to purchase digital in-car video systems.

2. Acquire and implement the Decatur Gemini digital in-car video system.

3. Coordinate in-car camera installation with Fleet Management. The agency already has analog Decatur systems in operation and installation of the new digital system is the same.

4. Provide training for officers receiving the digital in-car camera.

5. Coordinate and customize the system's data management and hardware installation with Dave Duda.

6. Provide training for the Videotape Custodian on the management of the data. Include training on duplicating digital recordings requested by the State Attorney's Office (SAO), Internal Affairs (IA), and other interested parties.

Detailed Findings:

1. On March 02, 2005, Officer Davis and I met with Stacia Carter of Kustom Signals. Ms. Carter gave a presentation on Kustom's "NXT" digital system. Ms. Carter provided a brochure and discussed options for the camera, controller, recording device, data transfer and management, compression, installation, and costs. Ms. Carter did not bring an operational system for us to evaluate.

   The camera is a compact color Sony. It offers a twelve to one (12:1) optical zoom lens ratio and a twenty-eight to one (28:1) digital zoom ratio. Optical zoom lens usage will bring in a subject closer to view, without degrading the video quality. Optical zoom lenses are more expensive when higher ratios are incorporated. Digital zoom usage will allow for nearly infinite ratios, but will degrade the quality of the video. The Sony also has backlight compensation so night video provides more visibility in poor lighting conditions and reduce washout (blooming) as headlights pass across the camera lens.

   There are three controller options including an integrated overhead console. The console includes the controller and monitor (3.5" color), separate controller and monitor (3.5" color), and using a laptop as both controller and monitor. The Panasonic Toughbook the agency currently has in operation could be used for the last option. The controller permits manual record on/off, remote record via wireless microphone, and auto recording based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights, siren, and when interfaced with a radar unit, the speed of the Officer's vehicle and/or the target vehicle.

   If the HDD option is selected for the overhead console or separate controller (laptop systems are preconfigured), an Intel Pentium III Celeron processor is used. Up to four cameras and two microphones can be connected to the system. Pre-event recording can automatically capture up to three minutes of video prior to record activation. This is accomplished by recording a preset time in a continuous loop. When the camera is activated to record, the pre-event loop is captured and recorded ahead of the triggered recording.

   Once the video is recorded onto the HDD, it can be transferred using one of three optional methods. The HDD can be removed from the console and placed in a docking station for data transfer. A Local Area Network (LAN) line can be plugged in to the console and data transferred over the line. The last option is to use a wireless "Mesh Network" system. The wireless upload method has data security and transfer rate concerns. Since the data travels across open airwaves, it could be captured by the general public if not properly secured. Wireless systems typically employ the 802.11g system and uploads are much slower than a LAN line. More than one system can be within the wireless "Mesh Network." Resources could be shared and the speed would be proportionally reduced.

   The NXT also offers the Moving Pictures Experts Group (MPEG) standard of audio/video compression. MPEG can be used under the 1, 2, 4, 7, or 21 standards. The NXT allows the end-user to choose MPEG1, MPEG2, or MPEG4. MPEG1 is the simplest audio/video compression standard, but this setting allows two to four times the amount of recording time before the HDD is filled. MPEG1 is roughly equivalent to

the Video Home System (VHS) standard of 30 frames per second. MPEG2 is the standard used by the television industry and Digital Versatile Disk (DVD) recordings for its high quality digital images. However, it will only record a quarter of the amount of audio/video that is recorded by an MPEG1 system. MPEG4 scales down the MPEG2 standard, which provides a better quality than does MPEG1, but records twice the data of MPEG2. To put these standards into perspective, a 40 gigabyte (GB) HDD can hold 88 hours of MPEG1 data, 22 hours of MPEG2 data, and 44 hours of MPEG4 data.

After data is transferred to a computer server, it can be managed according to the agency's requirements. Copies can be made to VHS tapes, Digital Versatile Disk – Recordable (DVD-R) for single use recording, and Digital Versatile Disk – Random Access Memory (DVD-Ram) for erasing and reusing.

The cost for the systems depends on the selection of features and ranges from $5,760 to $6,260 each. These prices do not include the cost of a computer management system.

[See Addendum 1 – Kustom Signals "NXT" Brochure]

2. On March 08, 2005, Officer Davis and I attended the vendor show for the Panasonic Arbitrator system. The system is a collaborative venture partnering Panasonic, IBM, and Insight Video Net. They provided a brochure, PowerPoint presentation, and discussed options for the camera, controller, recording device, data transfer and management, compression, installation, and costs. A fully operational system was set up for us to evaluate.

The camera offers a twenty-two to one (22:1) optical zoom lens ratio and a ten to one (10:1) digital zoom ratio. Optical and digital zoom usage will bring in a subject closer to view. The camera has low light and infrared imaging to enhance images under minimal lighting conditions. This includes back light compensation.

The Arbitrator system can utilize the Panasonic Toughbook laptop computers GPD currently has in operation, to control the camera and recorder. This system permits manual record on/off, remote record via wireless microphone, and auto recording based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights, siren, doors, shotgun rack, airbag, speedometer, and the speed of the Officer's vehicle and/or the target vehicle, when interfaced with a radar unit, Pre-event recording can be programmed to capture up to one and a half minutes of video.

The Arbitrator's recording system uses a proprietary memory card (P2 card), which holds 16 hours of video. The video is recorded using the MPEG4 standard. One method of video transfer to a server is using a wireless 802.11g, which has a transfer rate of approximately 15 minutes for every 8 hours of video. Wireless transfer rates slow down as more units attempt to access the wireless network. Wireless networks have to be secured so unauthorized video capturing does not occur. An optional Ethernet wired transfer would be more secure. Data would be stored on a server, which should be separated from the agency's current network.

After data is transferred to a computer server, it can be managed according to the agency's requirements. Copies can be made to Digital Versatile Disk – Recordable (DVD-R) for single use recording, Digital Versatile Disk – Random Access Memory (DVD-Ram) for erasing and reusing, and to Compact Disk (CD) for small video files.

Panasonic's Arbitrator is not on State Contract and the vendor, Mr. Salveson, could not give a cost estimate for the system. When contacted two months later, Panasonic could not provide an accurate cost, but provided a cost basis of "less than $8400.00" for the camera systems only. The price did not include the management system or the storage memory.

[See Addendum 2 – Panasonic "Arbitrator" Brochure]

3. On March 15, 2005, Officer Davis and I met with Mike Yates of Custody Law Enforcement Video. Mr. Yates gave a presentation on the Custody "MDVR" (Mobile Digital Video Recorder) video system. Mr. Yates only had a camera and monitor available for evaluation. The on-board controls were not programmed and the system was not operational. Mr. Yates advised it would be a few months before a system was available for evaluation.

The camera offers a twenty-two to one (22:1) optical zoom lens ratio and a ten to one (10:1) digital zoom ratio. Optical and digital zoom usage will bring in a subject closer to view. The camera has low light and infrared imaging to enhance images under minimal lighting conditions. Custody has inputs for three cameras (front facing, rear seat, and body wearable) and three microphones (vehicle interior and two wearable body packs).

The Custody system is controlled via the display's keypad. This configuration permits manual record on/off, remote record via wireless microphone, and auto recording based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights and/or shock sensor in case of an officer-involved crash. Pre-event and post-event recording can be programmed to capture up to eight minutes of video. In the case of post-event recording, video continues to record, for the programmed time, after the system is manually turned off.

Custody's recording system uses an internal HDD, which holds 40 hours of video. Data is transferred using a HDD docking station. The video would be stored on the work station's 250 gigabyte HDD. The storage capacity is minimal. The work station includes a DVD burner for making copies for long term storage. There is an optional 200 DVD disk reader, which stores the actual DVD (similar to a jukebox) and allows network access to the video. There is also a second option of increasing HDD capacity and/or adding a server to the work station. Each server would hold 1.25 terabytes of video. Requested video copies would be made on the included DVD burner.

Custody's system is the most inexpensive of the systems evaluated. The price for the basic system is $3,999. The price includes the camera, in-car control panel/monitor, work station for docking the removable HDD and the software to manage the video storage. This does not include the cost of additional server storage ($4,000 for 1.25 terabytes), DVD storage/reader, or additional cameras (rear seat & body camera).

[See Addendum 3 – Custody "MDVR" Brochure]

4. On March 21, 2005, Officer Davis and I met with Russell Stegemann of Watch Guard. Mr. Stegemann came to GPD and presented their DV-1 system. He was able to show us the camera and monitor, but the systems control program was not yet functioning and could not be evaluated. This system is self-contained and installs above/beside the rearview mirror.

The front camera offers a twenty-two to one (22:1) optical zoom lens ratio and a twelve to one (12:1) digital zoom ratio. Optical and digital zoom usage will bring in a subject closer to view. The camera uses the Sony Ex-view programming to prevent blooming from on-coming headlights and a night setting for low-light conditions. Watch Guard has inputs for three cameras. The front and backseat cameras are standard. There is an optional rear camera.

The Watch Guard system is controlled via the display's keypad. This configuration permits manual record on/off, remote record via wireless microphone, and auto recording based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights, radar target speed or officer's speed (with optional radar interface) and crash detection. Pre-event and post-event recording can be programmed to capture up to ten minutes of video. In the case of post-event recording, video continues to record after the system is manually turned off for the programmed time.

Watch Guard's video is recorded direct to a DVD. No uploading or downloading required. Because of direct recording, the internal HDD is only used to control software and digital loop recording. The internal HDD records approximately 24 hours of video before it begins to loop back over itself. This means anything which passes in front of the camera can be captured after the fact and up to 24 hours later. Since the system records direct to a DVD, there are no memory storage requirements. The evidence management is similar to the current analog tape.

Watch Guard is priced at $4,995 for the complete system. Watch Guard offers pre-labeled evidence DVDs and storage for up to 4,000 discs as an option.

[See Addendum 4 – Watch Guard "DV-1" Brochure]

5. On March 23, 2005, Officer Davis and I met with Jeremy Jack of Decatur Electronics. Mr. Jack presented the Gemini digital system for evaluation. We were able to view an operational system installed in Mr. Jack's Ford, Crown Victoria. He also reviewed several actual and mock scenarios pre-recorded for demonstration. This system is

self-contained and installs above and to the right of the rearview mirror. Decatur Electronics is the only vendor to meet ISO 9001 certification.

The Sony camera offers a ten to one (10:1) optical zoom lens ratio and a four to one (4:1) digital zoom ratio. Optical and digital zoom usage will bring in an object closer to view. It can also be rotated 360 degrees so the field of view can be adjusted. The camera is low light imaging to enhance images under minimal lighting conditions. It also resists nighttime blooming of headlights and smearing of images.

Decatur's Gemini is controlled by the touch screen display. This configuration permits manual record on/off, remote record via wireless microphone, and auto recording based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights and radar target speed or officer's speed (with optional radar interface). Pre-event recording can be programmed to capture up to five minutes of video. While the system is recording, the Officer can touch anywhere on the screen and the segment will be tagged. This feature gives anyone reviewing the video the ability to go directly to tagged segments and review video of activity worth noting. This could be a location of importance (crowded street), a driving action (weaving pattern), an occupant action (evidence discarded out the window), etc.

Decatur's recording system uses a removable HDD, which holds 16 hours of video. The video is recorded using the Joint Photographic Experts Group (JPEG) movie standard. The HDD is removed from the console and placed in a docking station for data transfer. Data would be stored on a server, which should be separated from the agency's current network.

After data is transferred to a computer server, it can be managed according to the agency's requirements. Copies can be made to DVD-R for single use recording, DVD-Ram for erasing and reusing, and to CD for small video files.

Decatur provided quotes for several system configurations (number of cameras - 4, 5, 6, 10, and 40), with the six system configuration being most economical at $40,929. This configuration is for six complete systems, including cameras, computer hardware and software, minimal storage, and docking station.

[See Addendum 5a – Decatur Electronics "Gemini" Brochure]
[See Addendum 5b-f – System Purchase Quotes]

6. On March 24, 2005, Officer Davis and I met with Phil Redstone of Cruise Cam. He demonstrated Cruise Cam using an operational system installed in his vehicle and reviewed its options and capabilities. The system is made up of several components, which are installed separately in the vehicle. The camera is mounted by cutting the front passenger seat and installing it to the seat's frame. The camera offers a forty to one (40:1) optical zoom lens ratio and a ninety to one (90:1) digital zoom ratio. The controller and recorder can be installed in several areas of the vehicle, according to the agency's preference.

Cruise Cam has three primary configurations which can be customized to meet the agency's needs and budget. The first option is to use the agency's existing laptops as

both the video monitor and controller. The second option uses a Cruise Cam monitor and keypad to control and record to a removable HDD. The third option uses an internal HDD and then burns the video direct to DVD.

Cruise Cam records manually from the controller (laptop or monitor), remote via wireless microphone, and automatically based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights and siren. Pre-event recording can be programmed to capture up to two minutes of video. The video is compressed using Discrete Cosine Transform (DCT), which reduces the amount of data storage required. This compression formula also reduces the amount of time required to transfer video.

Recorded video is transferred by one of three methods. First, the video can be transferred by 802.11g with upload hotspots. Wireless transfer rates slow down as more units attempt to access the wireless network. Wireless networks have to be secured so unauthorized video capturing does not occur. The second option is Ethernet wired transfer would be more secure. With option three, video is recorded direct to DVD.

After data is transferred to a computer server, it can be managed according to the agency's requirements. Copies can be made to DVD-R for single use recording, DVD-Ram for erasing and reusing, and to CD for small video files.

The first Cruise Cam option, using the agency's existing laptops, starts at $4,995 a system. The second option, with removable HDD, starts at $5,500 a system. The third option, with direct to DVD recording, starts at $6,200 a system. This does not include the proprietary software, which will cost an additional $300 to $600 per system, depending on configuration. It does not include docking station hardware, software to manage the data, or software to view the video. These costs do not include the server required to maintain the video.

[See Addendum 6 – Cruise Cam Brochure]

7. On April 15, 2005, while at the State Attorney's Office (SAO) on unrelated business, I was approached by Spencer Mann. He and I were talking about my assignment as Video Evidence Custodian and he asked about the Department's plans for video formats. I explained I was researching digital in-car video systems. Mr. Mann gave me a tour of the SAO video processing area, in order to show how video evidence is handled once received. He explained most Investigators and Assistant State Attorneys either have DVD players or have easy access to one. He is a proponent of digital video and said the SAO would prefer the digital format over the current analog tapes. He looks forward to a transition to the digital format.

8. On April 21, 2005, Sergeant T. Hayes of SID invited me to sit in on a presentation given by Jarrett Bell of Digital Safety Systems. Sergeant Hayes had requested the presentation for an unrelated use. The system has four components which are installed separately in the vehicle. The Sony camera is mounted above and to the right of the rearview mirror. The camera offers an eighteen to one (18:1) optical zoom lens ratio and a seventy-two to one (72:1) digital zoom ratio. The controller and recorder can be installed in several areas of the vehicle according to the agency's preference.

Digital Safety Systems' recordings are activated manually from the keypad, remotely via wireless microphone, and auto recorded based on configuration. The auto recording feature can be programmed to activate the system with the emergency lights and siren. Pre-event recording can be programmed to capture up to five minutes of video. Video is recorded using the MPEG4 standard. This standard allows up to 36 hours of video to be recorded onto a 30 gigabyte HDD.

Digital Safety Systems includes an internal Global Positioning System (GPS) which records location in longitude and latitude format. The system operator can also flag points during an event to electronically mark a video segment as important. Flagging the video will allow the operator to quickly locate each video segment and review it for additional information. Combined with the GPS, this feature would enable a member to return to exact coordinates to locate or retrieve evidence. It also has an option of connecting a radar unit to the system, which can record the target and/or the patrol vehicle speed.

Data transfer is accomplished by one of two methods offered by Digital Safety Systems. The first is to use wireless 802.11g to an existing or separate network receiver. Data transfer rates are approximately 6 minutes for each hour of video. Since more than one vehicle can be within the wireless zone, the transfer rate would be reduced according to the number of vehicles. Mr. Bell recommended the second option, which uses an Ethernet wire to directly transfer the data. The data transfer rate is much quicker at approximately 50 seconds for each hour of video. It is also a more secure method of transfer. Two vehicles can transfer data from a single vehicle docking station without reducing the rate of transfer.

After data is transferred to a computer server, it can be managed according to the agency's requirements. Copies can be made to VHS tapes, DVD-R for single use recording, and DVD-Ram for erasing and reusing.

The cost for the system is not finalized, but is expected to be in the "upper $5,000." Digital Safety Systems has partnered with Dell and the pricing is dependent on configuration of the Dell server, which is approximately $10,000. The pricing for the server storage is not included in the price provided. The type of transfer system (Ethernet or wireless) is a separate cost, with Ethernet being the cheaper option at $500 per station.

[See Addendum 7 – Digital Safety Systems Brochure]

9. On April 26-28, 2005 Officer Davis and I attended the training provided to GPD members who currently have an in-car video system. We invited all attendees back for a demonstration arranged with Panasonic and Decatur for the afternoon of April 28th. Members were asked to evaluate the two systems and then complete a survey on eleven different aspects of each system. The data from the surveys was compiled to determine a preference of the members. Decatur was rated just ahead of the Panasonic system, as both were thought to be excellent systems. The only complaints heard were concerning Panasonic's multiple components (three pieces), placement, and complicated operation of Panasonic's features. Officers stated they were unhappy

with how Panasonic occupied the little space left in their vehicles. They preferred the self contained overhead installation of the Decatur system.

[See Addendum 8 – Panasonic vs. Decatur Survey]

10. On June 14, 2005, Jeremy Jack with Decatur Electronics returned to meet with Dave Duda, Officer Davis, and myself. Mr. Duda shared his concerns with the security of the data being transferred over a wireless network and the storage requirements of the video data. Mr. Jack recommended the docking station due to security concerns with wireless transfers and the possibility of unauthorized wireless data capture. Mr. Jack also recommended the server network be configured separately from the agency's existing network. Mr. Duda expressed his preference in the separated network system based on the demand the video system would place on the agency's existing network. With a separate server and network, Mr. Duda was confident the data transfer and storage would be secure and not reduce efficiency of the current network.

11. On July 6, 2005, I spoke to Corporal Dan Stout concerning the grant funding available for in-car video systems. He stated the agency has already received a Justice Assistance Grant (JAG) which included $40,929 set aside for in-car video systems. This money can be used for the purchase of any in-car video system including the digital format. Corporal Stout is also researching grants in search of additional money for digital in-car video systems.

Addenda

1.   Kustom Signals – NXT Brochure

2.   Panasonic – Arbitrator Brochure

3.   Custody – MDVR Brochure

4.   Watch Guard – DV-1 Brochure

5a.   Decatur Electronics – Gemini Brochure

5b-f.   Decatur System Purchase Quotes

6.   Cruise Cam – Digital System Brochure

7.   Digital Safety Systems Brochure

8.   Panasonic vs. Decatur Survey