Archive

KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

Title: License Plate readers		**Section Assigned:**	Special Projects and Programs
Desc. of Project (Primary):	Research	**Priority:**	Normal
Desc. of Project (Secondary):		**Date Received:**	11/25/2008
Desc. of Project (Other):		**Supervisor T Date:**	1/30/2009
		Supervisor T Date (Rev)	
Initiated By Organization:	PRD	**Submitted Date:**	1/12/2009
Initiated By Last Name:	Smith		
Initiated By First Name:	Rick	**Supervisor Last Name:**	Hicks
Initiated By Rank/Title:	Captain	**Supervisor First Name:**	Michael
Initiated By Contact Info:		**Supervisor Rank/Title:**	Sergeant
		Project Status:	Closed
Materials Attached ☐		**Date Hold:**	
Materials Attached (Type of):		**Date Closed:**	7/7/2009
Reference:		**Tickle Flag** ☐	
		Tickle Date	
		Closing Commander/Supervisor	Sgt. Hicks

Comments:

Research the cost of installation for automated license plate readers. Price per unit, different compaines, research use in other cities (Cincinati), pros and cons.

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KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

Project Activity History

There are no Activity Entries for this project

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KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

Project Routing History

There are no Routing Entries for this Project

KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

There are no T-Date Revision Entries for this Project

KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

Project X-Reference History

There are no X-Ref Entries for this Project

KANSAS CITY, MISSOURI POLICE DEPARTMENT

PLANNING AND RESEARCH UNIT

ENTIRE PROJECT REPORT

Project Number: 305

Project Assignment History

Date Assigned	Assigned To Last Name	Assigned To First Name	Assigned To Rank/Title	Assign Type	Assignment Reason
12/1/2008	Thompson	William	P.O.	P	

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Endorsement
Automated License Plate Reader
Officer William Thompson

Major Barton,

The project submitted by Officer Thompson states that several police departments are using Automated License Plate Reader (ALPR) technology to locate stolen autos. From a cost benefit approach stolen autos are not aggressively prosecuted in counties that Kansas City encompasses. For the expense it would make sense that some kind of buy-in from the county prosecutors in prosecuting stolen auto offenses may increase the cost benefit of an ALPR.

Automated License Plate Reader (ALPR) has potential, however, from the information submitted by Officer Thompson it appears that the ALERT System really hampers the system. I agree with Sergeant Hicks an ALPR would be better suited with updated technology. The department is moving in that direction with REJIS. I would recommend that this project be tabled until REJIS is implemented allowing for an ALPR to be used to it's potential without added man-hours being utilized to make the system work.

3/2/09

Capt. Smith, 02/26/2009

Automated License Plate Recognition products enhance the tools associated with the apprehension of wanted persons, homeland security, and investigations. Currently, ALPR products are cost prohibitive for installation in multiple mobile or fixed platforms. The total cost can be minimized by using specialized or strategic deployment. Some cities have deployed ALPR products in specialized units (Stolen Auto Units) and purchased one or only a few ALPR products rather than purchasing units to outfit all patrol cars.

The primary barrier to the Kansas City Missouri Police Department utilizing ALPR technology is the interface with the ALERT system. The ALERT system cannot interface with the ALPR software in real time. ALERT cannot provide a constant stream of updated information to the ALPR system. This severely prohibits the ALPR and its use. The Lenexa Kansas, Police Department has a test ALPR system. They manually enter license plate data received from our ALERT system each day because the ALPR system will not interface with ALERT in real time. This defeats the purpose of a mobile license plate recognition platform.

I do not believe that the purchase of ALPR products is feasible at this time. Besides the high cost per unit, the ALPR software is not compatible with ALERT in real time. ALPR products may be feasible if the police department upgrades the ALERT system or implements a new criminal justice database system that can interface with the ALPR software in real time.

On March 31, 2009, the Lenexa Police Department is holding a demonstration of the ALPR product that they are testing. P.O. Thompson and I will be attending the demonstration as a follow to this project.

Sgt. M. Hicks

Sgt. Michael Hicks 4125
Special Projects Section

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LENEXA POLICE DEPARTMENT

&

ELSAG NORTH AMERICA

2009 LICENSE PLATE READER PURCHASING PROGRAM

Possible Uses:

Identify chronic parking violators, stolen vehicles, stolen plates, felony warrants, registered sex offenders, parolees, cancelled and revoked driver's licenses, gang members, repo vehicles, plus anything that can be connected to a license plate number.

Pricing:

Item#	Description	1-4 Units	5-9 Units	10-24 Units	25+
MPH-900X1 (Perm or Trans)	MPH-900X1 (Perm includes parts, installation and labor. Trans includes magnet mounts and proper cables.)	$14,975	$14,057	$13,120	$12,975
MPH-900X2 (Perm or Trans)	MPH-900X2 (Perm includes parts, installation and labor. Trans includes magnet mounts and proper cables.)	$19,975	$18,750	$17,500	$17,100
MPH-900X3 (Perm or Trans)	MPH-900X3 (Perm includes parts, installation and labor. Trans includes magnet mounts and proper cables.)	$23,725	$22,425	$19,975	$18,750
MPH-900X4 (Perm or Trans)	MPH-900X4 (Perm includes parts, installation and labor. Trans includes magnet mounts and proper cables.)	$27,525	$26,100	$22,550	$21,400
MPH-900 OPC	MPH-900 Operations Center License per car system	$975	$975	$825	$650

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Customer Service 866.9MPH900
412 Clock Tower Commons
Brewster, NY 10509
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MEMORANDUM

March 2, 2009

TO: Sergeant Michael Hicks, Supervisor, Planning and Research Division

FROM: Officer William Thompson, Special Projects Section

SUBJECT: Automated License Plate Recognition

On November 25, 2008, I began researching Automated License Plate Recognition (ALPR) technology. This technology utilizes multiple infrared and color cameras mounted on a police vehicle or in a static platform. The camera captures an image of a license plate and converts the image into data. The ALPR software integrates with criminal justice database systems utilizing the converted image data for license plate queries. In 2008, the Space and Naval Warfare Systems Center, Atlantic completed an assessment of ALPR products (Annex A). The assessment, funded by the U.S. Department of Homeland Security, researched four companies that sell ALPR products. PIPS Technology ranked the highest in the assessment of ALPR equipment.

I contacted representatives at four ALPR companies: Gentec Incorporated, PIPS Technology, Coban Technologies Incorporated, and Plate Scan. I asked 16 specific questions regarding their products and documented each response (Annex B). One of the many factors with this technology is cost. The ALPR products cost on average $20,000 per car, for a mobile system. Static systems range from $10,000 to $15,000, per lane of traffic. Another factor is warranty. All four ALPR companies researched only have a one-year parts and labor warranty. Three police departments that currently utilize an ALPR system (Annex C) responded to a survey I e-mailed to the International Association of Law Enforcement Planners. All three departments use PIPS Technology ALPR products to locate stolen autos and outstanding warrants.

The Kansas City Missouri Police Department currently uses Coban Technologies Incorporated products for the digital in-car video system. This company has ALPR products available that upgrades the current in-car digital video system. Utilizing the Coban products already installed in department police vehicles is possible, but additional cameras and software updates would be necessary. Additional hardware installation and software upgrades could cost up to $12,000.00 per car.

In 2007, the Planning and Research Division researched ALPR technology for the first time (Annex D). The Kansas City Crime Commission agreed to fund the purchase of an ALPR product for the Kansas City Missouri Police Departments Gang Unit. During the research, the commission chose not to move forward with the purchase of an ALPR system; the project closed. Also is 2007, Sergeant Jay Pruetting of the Gang Unit attended a demonstration of the PIPS Technology ALPR system. He said that the system was not usable due to the ALPR software would not integrate in real time with ALERT.

I contacted Ms. Harriett Williams of the Computer Programming Section. She stated the ALERT system could provide the data to an ALPR system via a manually created file uploaded to the company's ALPR system at specified time intervals. ALERT cannot automatically update in real time an ALPR system. The license plate information would be manually entered which could take two and one half hours for each update. This severely restricts the usability of an ALPR system and defeats the goal of the system, which is locating stolen vehicles and outstanding warrants with captured license plate data in real time.

The Lenexa Police Department is currently testing an ALPR system from ESLAG North America. Officer Dave Willis of the Lenexa Police Department said the ALPR system would not connect with ALERT. The warrant information is manually entered into the ALPR system each day, which is time consuming. Officer Willis is working with Ms. Williams on a format that would not take as long. The Lenexa Police Department is planning a demonstration of the ALPR system in March for other law enforcement departments to attend.

This project is complete and submitted for your approval.

P.O. William Thompson 4433

Officer William Thompson 4433
Special Projects Section

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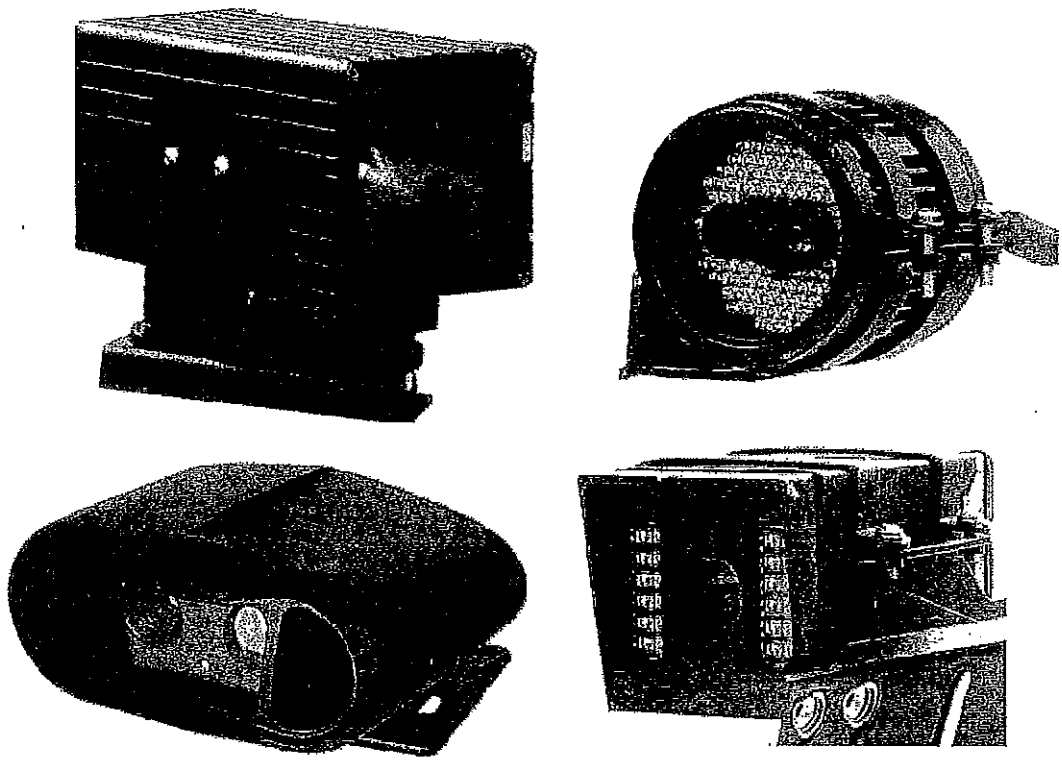
ANNEX A

Mobile License Plate Recognition Systems Assessment Report (Oct. 2008) by Space and Naval Warfare Systems Center, Atlantic



SYSTEM ASSESSMENT AND VALIDATION FOR EMERGENCY RESPONDERS (SAVER)

Mobile License Plate Recognition Systems Assessment Report

October 2008

FEMA

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders

Prepared by Space and Naval Warfare Systems Center, Atlantic

The Mobile License Plate Recognition Systems Assessment Report was funded under Interagency Agreement No. 2003-TK-R-040, from the U.S. Department of Homeland Security, Federal Emergency Management Agency.

Foreword

The Federal Emergency Management Agency (FEMA) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. The SAVER Program conducts objective operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the U.S. Department of Homeland Security's Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, and operationally oriented assessments and validations of emergency responder equipment.
- Providing information that enables decision makers and responders to better select, procure, use, and maintain emergency responder equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life-saving and cost-saving asset to FEMA, as well as to federal, state, and local responders.

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

As a SAVER Program Technical Agent, the Space and Naval Warfare Systems Center (SPAWARSYSCEN), Atlantic, has been tasked to provide expertise and analysis on key subject areas, including communications, sensors, security, weapon detection, and surveillance, among others. In support of this tasking, SPAWARSYSCEN Atlantic conducted a comparative assessment of mobile license plate recognition systems.

Visit the SAVER Program Web site at https://saver.fema.gov for more information on the SAVER Program or to view additional reports on mobile license plate recognition systems or other technologies.

Points of Contact

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Executive Summary

Tasked by the System Assessment and Validation for Emergency Responders (SAVER) Program, the Space and Naval Warfare Systems Center (SPAWARSYSCEN), Atlantic, conducted an assessment of currently available mobile license plate recognition (LPR) systems based on criteria established by a focus group of law enforcement officers. Mobile LPR systems are permanently or temporarily mounted to a vehicle and are comprised of a suite of components, including cameras, computer hardware, software, and databases. These components work together to: 1) capture an image of a license plate, 2) recognize the license plate characters by converting the characters in the image into readable text, and 3) check the license plates against designated databases for identification. The results of this assessment are intended to help law enforcement agencies make informed decisions when procuring mobile LPR systems.

Based on product selection criteria established by the focus group, four mobile LPR systems were assessed:

- CarDetector by Vigilant Video
- Mobile Plate Hunter 900 (MPH-900) by ELSAG North America (formerly Remington ELSAG)
- PAGIS by PIPS Technology
- PlateScan by Civica Software

Law enforcement officers familiar with LPR technology evaluated each system using step-by-step procedures and simulated operational scenarios. The officers provided feedback and rated assessment criteria on a scale of 1 to 5, with 1 being least favorable and 5 being most favorable. Without endorsing any particular mobile LPR system, this document reports the product's overall score, the average criteria ratings, and evaluator feedback for each product.

Of the assessed systems, the PAGIS system received the highest overall score. Evaluator feedback highlighted the system's ability to capture most of the license plates encountered during the assessment scenarios. The evaluators also emphasized the PAGIS system's ability to accurately recognize target license plates during the assessment. Evaluators also commented that the system's user interface and configurable features would help them work more efficiently. The MPH-900 received the second highest overall score. Evaluators agreed the system would be useful to law enforcement due to its plate recognition accuracy, relative ease of use, and quick delivery of system alerts. PlateScan received the third highest overall score. Evaluators indicated that PlateScan's simplistic graphics and logically organized user interface required minimal user interaction and enabled quick response to database matches, contributing to officer safety while driving. The evaluators also noted, however, that they would prefer the system to capture and accurately recognize license plates more frequently. CarDetector received the lowest overall score. The evaluators commented that CarDetector's two-year warranty adds value to the system, and the compact equipment saves space in the trunk and facilitates covert operations. The evaluators agreed, however, that the CarDetector system was least likely to meet law enforcement needs due to its ineffective organization of graphics and user functions, an inability to configure system access by user, slow display of captures and alerts, and inadequate processing unit construction.

1. Introduction

License plate recognition (LPR) systems automatically identify vehicles by the information on their license plates. Checking license plates without an LPR system requires the officer to read the plate, then radio or type license plate information into a system, one plate at a time, and wait for the system to return any results. This time-consuming and labor-intensive task slows an officer's ability to pursue the vehicle in question if warranted by the results of the license plate check.

LPR systems use cameras, computer hardware, and software to capture an image of a license plate, recognize the license plate characters by converting the characters in the image into readable text, and then check the license plate against designated databases for identification. LPR systems can scan thousands of license plates during a patrol shift or targeted mission. Some examples of law enforcement applications for LPR systems include stolen vehicle recovery, wanted felon identification, and parking enforcement.

Tasked by the U.S. Department of Homeland Security (DHS) for the System Assessment and Validation for Emergency Responders (SAVER) Program, the Space and Naval Warfare Systems Center, (SPAWARSYSCEN) Atlantic, conducted a comparative assessment of mobile LPR systems. During July 2008, four mobile LPR systems were assessed to provide information on the capabilities and limitations of these systems to emergency response agencies.

1.1 Assessment Scope

The assessment focused on mobile LPR systems for U.S. law enforcement applications. The assessment was structured according to criteria and operational scenarios identified by a focus group of law enforcement officers who use mobile LPR systems. For more information about the focus group, refer to the *Mobile License Plate Recognition Focus Group Recommendations*, which can be found on the SAVER Web site at https://saver.fema.gov.

Generally, there are two types of LPR systems—fixed and mobile. Fixed systems are permanently mounted on stationary structures, such as poles or walls. In contrast, mobile systems are either permanently or temporarily mounted on a vehicle.

1.2 Evaluator Demographics

Four law enforcement officers, all experienced mobile LPR system users, served as the evaluators. Table 1-1 provides the evaluators' background information.

Table 1-1 Evaluator Demographics

Rank	Years of Experience	Jurisdiction
Officer	9	Georgetown Police Department, SC
Officer	13	North Charleston Police Department, SC
Sergeant	15	Long Beach Police Department, CA
Sergeant	24	Miami-Dade Police Department, FL

1.3 Assessment Products

The nine mobile LPR systems described in the *Mobile License Plate Recognition Systems Market Survey Report* were considered for this assessment. The products were compared as complete systems of cameras, software, processors, and displays in order to keep comparison between products consistent and relative. Although vendors offered data management server hardware and software for data mining, analysis, and investigations, it was not part of the image capture, processing, and matching process and therefore not assessed. The systems were scored and selected for the assessment according to how well each product met the focus group's product selection criteria described in the *Mobile License Plate Recognition Systems Focus Group Recommendations*. Product information used for comparison with product selection criteria was obtained directly from vendor responses to a Federal Business Opportunity (FedBizOpps) Request For Information (RFI).

The following mobile LPR systems were assessed based on product selection scoring:

- CarDetector by Vigilant Video
- Mobile Plate Hunter 900 (MPH-900) by ELSAG North America (formerly Remington ELSAG)
- PAGIS by PIPS Technology
- PlateScan by Civica Software

1.4 Authorized Equipment List

Local jurisdictions use the DHS Authorized Equipment List (AEL) guidelines to comply with federal grant requirements in their selection of equipment for procurement. DHS directs state and local responders to refer to specific program guidelines for the list of authorized equipment eligible for purchase through that particular grant program. AEL reference number 14SW-01-SIDV, from the AEL dated January 17, 2008, pertains to systems for vehicle identification.

2. Assessment Criteria

The SAVER Program assesses products based on criteria in five established categories:

- Affordability – Criteria related to life cycle costs of a piece of equipment or system.
- Capability – Criteria related to the power, capacity, or features available for a piece of equipment or system to perform one or more responder relevant tasks.
- Deployability – Criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.
- Maintainability – Criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders.
- Usability – Criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

The focus group identified, defined, and categorized 39 mobile LPR system assessment evaluation criteria within the five SAVER Program categories. The focus group then assigned a weight for each criterion's level of importance on a scale of 1 to 5, with 1 being somewhat important and 5 being of utmost importance. Once the criteria were weighted, the five SAVER Program categories were assigned a percentage value to represent each category's level of importance relative to the other categories.

Products were assessed according to 20 of the 39 assessment criteria within four SAVER Program categories. The remaining criteria, including all the criteria in the affordability category, were not assessed, as noted in Table 2-1, because they are agency-specific or information needed for the assessment was not available. Refer to Appendix A for the assessment criteria definitions provided by the focus group.

Table 2-1 Assessment Criteria

SAVER PROGRAM CATEGORIES				
Affordability	**Capability**	**Usability**	**Deployability**	**Maintainability**
Overall Weighting 31%	**Overall Weighting 29%**	**Overall Weighting 20%**	**Overall Weighting 13%**	**Overall Weighting 7%**
Evaluation Criteria				
Initial System Cost Not Assessed	**System Accuracy** Weight: 5	**Visual Display** Weight: 5	**Integration with Existing Car Systems** Not Assessed	**Customer Support** Not Assessed
Ongoing Maintenance Costs Not Assessed	**Alert Time** Weight: 5	**Alert Information** Weight: 5	**Processing Unit Durability** Weight: 5	**Warranty** Weight: 5
Cost of Optional Equipment Not Assessed	**Plate Reading Conditions** Weight: 5	**User Friendly Interface** Weight: 4	**Camera Durability** Weight: 5	**Backwards Compatibility** Not Assessed
Cost of Required Software/Hardware Not Assessed	**Field of View** Not Assessed	**Character Estimation** Weight: 4	**Camera Size** Weight: 3	
Volume Discount Not Assessed	**Operating System Compatibility** Not Assessed	**Ease of Startup and Shutdown** Weight: 3	**System Portability** Not Assessed	
	Speed Differential Weight: 4	**Training** Not Assessed	**Camera Mounting** Not Assessed	
	Multiple Database Query Weight: 4		**Processing Unit Size** Weight: 2	
	Location Detection Weight: 4		**Integration with In-Car Cameras** Not Assessed	
	Processing Unit Networkability Not Assessed			
	Manual Database Entry Weight: 4			
	System Security Weight: 3			
	Statistic Reporting Weight: 3			
	Database Management Software Availability Not Assessed			
	Data File Formats Supported Not Assessed			
	Configurable Images Weight: 1			
	Database Hit Notifications Not Assessed			
	System Power Consumption Not Assessed			

3. Assessment Methodology

Evaluators assessed one product per day. Before beginning the assessment each day, an overview of the system to be assessed and training were provided by the vendor. The assessment was conducted as follows:

- Equipment/Feature Assessment: Before, during, and after the performance assessment, evaluators assessed products using criteria related to equipment practicality and user functions.
- Performance Assessment: Evaluators assessed products in three operational scenarios using criteria related to performance effectiveness.

After completing the assessment activities for a product, evaluators rated the product according to the assessment criteria on a scale from 1 (least favorable) to 5 (most favorable), and provided written and verbal feedback.

3.1 System Configuration

Vendors were required to provide all system components installed on a Ford Crown Victoria or a vehicle with a similar profile for the assessment. Prior to the assessment, each participating vendor was provided with information to ensure their system was configured according to the assessment criteria and consistent with the other assessed systems. Specifically vendors were provided with:

- Target plate-mounting location on vehicle rear.
- Scenario fields of view and descriptions (See Section 3.2).
- Issuing state for the target plates (See Section 3.2).
- A mock license plate data file containing license plate records for the target vehicles and instructed to have the file loaded on the system upon arrival at the assessment site.

In addition, vendors were encouraged to equip their system with GPS tracking on a visual map, an optional capability for many systems.

3.2 Assessment Execution

To conduct the assessment, evaluators were provided with step-by-step procedures to ensure consideration was given to each assessment criterion. For the equipment/feature assessment, evaluators used the procedures to examine the system's equipment and navigate the user interface.

For the performance assessment, products were evaluated in the following three real-time scenarios, representing operational environments recommended by the focus group:

- Patrolling Parking Lot: Patrolling at a slow speed (5 to 10 miles per hour), the systems targeted vehicles parked at a 90 degree angle on the passenger side.
- Monitoring Heavy, High Speed Traffic: Parked on a highway shoulder, the systems targeted passing traffic (50 to 60 miles per hour) on the driver's side.
- Patrolling Two-Lane Highway: Patrolling at a moderate speed (45 to 55 miles per hour), the systems targeted oncoming traffic on the driver's side.

Each scenario was performed four times, giving each evaluator an opportunity to interact directly with the system. Four vehicles with the following plate types were staged as targets in each scenario:

Pennsylvania – reflective background, raised characters

South Carolina – reflective background, raised characters

South Carolina – reflective background, non-raised characters (i.e., a flat plate)

South Carolina – reflective background, raised characters, two characters partially obscured with black tape

3.3 Data Collection Analysis

Using the evaluators' ratings, an overall product score was calculated for each product based on the assessment criteria and SAVER category weights established by the focus group. Refer to Appendix B for the methodology used to calculate the overall product scores. Evaluators' written and verbal feedback about each product was analyzed for pros, cons, and trends.

4. Assessment Results

Of the assessed systems, the PAGIS system received the highest overall score. Evaluator feedback highlighted the system's ability to capture most of the license plates encountered during the assessment. The evaluators also emphasized the PAGIS system's ability to accurately recognize target license plates during the assessment. Evaluators also commented that the system's user interface and configurable features would help them work more efficiently.

The MPH-900 received the second highest overall score. Evaluators agreed the system would be useful to law enforcement due to its plate recognition accuracy, relative ease of use, and quick delivery of system alerts.

PlateScan received the third highest overall score. Evaluators indicated that PlateScan's simplistic graphics and logically organized user interface required minimal user interaction and enabled quick user response to database matches, contributing to officer safety while driving. The evaluators also noted, however, that they would prefer the system to capture and accurately recognize license plates more frequently, adding that they would forego the efficient user interface in lieu of improved recognition accuracy and a higher rate of plate captures.

CarDetector received the lowest overall score. The evaluators commented that CarDetector's two-year warranty adds value to the system, and the compact equipment saves space in the trunk and facilitates covert operations. The evaluators agreed, however, that the CarDetector system was least likely to meet law enforcement needs due to its ineffective organization of graphics and user functions, an inability to configure system access by user, slow display of plate captures and alerts, and inadequate processing unit construction.

Throughout the assessment of all products, the weather conditions were mostly sunny. The evaluators agreed that none of the resulting glare and shadows encountered seemed to impact the capture and recognition performance of any of the products.

Table 4-1 displays the overall score for each assessed product from highest to lowest. Table 4-2 represents the average criteria ratings for each product within each assessed SAVER category. Specifications for the assessed equipment are listed in Table 4-3.

Table 4-1 Overall Assessment Score

Product	Overall Assessment Score	Overall	Capability	Usability	Deployability	Maintainability
PAGIS		4.4	4.5	4.6	4.4	3.5
MPH-900		4.0	4.0	4.0	4.0	4.0
PlateScan		3.5	3.0	3.9	3.8	3.8
CarDetector		3.1	3.2	2.4	3.5	4.5
	0.0 1.0 2.0 3.0 4.0 5.0					

Table 4-2 Average Criteria Ratings

KEY

Least Favorable ⇨ Most Favorable

Assessment Criteria			PAGIS	MPH-900	PlateScan	CarDetector
	Capability	System Accuracy				
		Alert Time				
		Plate Reading Conditions				
		Speed Differential				
		Multiple Database Query				
		Location Detection				
		Manual Database Entry				
		System Security				
		Statistic Reporting				
		Configurable Images				
	Usability	Visual Display				
		Alert Information				
		User Friendly Interface				
		Character Estimation				
		Ease of Startup and Shutdown				
	Deployability	Processing Unit Durability				
		Camera Durability				
		Camera Size				
		Processing Unit Size				
	Maintainability	Warranty				

Table 4-3 Key Specifications of Assessed Systems

Specification	PAGIS	MPH-900	PlateScan	CarDetector
Cost of Equipment and Software (as of July 2008)	$20,250	$22,825	$21,995	$15,100
Number of Cameras (Included in Cost)	3	3	4[a]	2
Camera Mounting Location and Size (D x W x H, Inches)	On Light bar 4 x 4 x 4	On Trunk 8 x 4 x 4	On Light bar 8 x 7 x 4 Inside Rear Window 3 x 2 x 2	On Rooftop 7 x 7 x 4
Processing Unit Size (D x W x H, Inches)	9 x 16 x 5	8 x 8 x 3.5[b]	10 x 13 x 3	6 x 4 x 2
Warranty Coverage (Included in Cost)	One Year for Parts, Labor, Repair, and Physical Damage Diagnostics	One Year for Parts, Labor, Repair, and Physical Damage Diagnostics	One Year for Parts, Labor, and Repair	Two Years for Parts, Labor, and Repair
User Interface Computer Hardware (Not Included in Cost)	Dashboard-Mounted Touch-Screen Monitor	Dashboard-Mounted Touch-Screen Monitor and Keyboard	Dashboard-Mounted Touch-Screen Monitor	Non-Mounted Laptop w/Touch-Screen

[a] Includes three cameras for mounting on a light bar and one camera for mounting to the inside of the rear window.

[b] The dimensions are for a junction box, which supplies power to the cameras and connectivity from the cameras to the user interface computer.

4.1 PAGIS by PIPS Technology

The PAGIS system received the highest overall score, 4.4. Evaluators frequently commented on the PAGIS system's effective performance, efficient user interface, and durable equipment. Although the evaluators noted some concerns regarding the large size of the processing unit, the system's performance outweighed these concerns. The system was installed on a Ford Crown Victoria and configured with a dashboard-mounted touch-screen monitor, a trunk-mounted processing unit, and three light bar-mounted cameras.

Pros	• Accurate plate recognition • High plate capture rate • Flexible configuration options for databases, security, and alerts • Logically organized, uncluttered user interface for minimal officer interaction • Ruggedized processing unit
Cons	• Non-adjustable image resolution • Limited in-car reporting • Processing unit infringes on trunk space

The following sections, broken out by SAVER categories, present the evaluators' written and verbal feedback.

Capability

The majority of evaluator feedback regarding the PAGIS system's capabilities was positive. The evaluators considered the system highly effective, missing 1 out of 48 possible target plate captures, while also capturing almost every non-target vehicle plate parked or driving in the areas where the scenarios were conducted. The evaluators also considered the system to be highly accurate, correctly recognizing 44 of the 47 captured target plates. Only the partially obscured plate was not captured or was incorrectly recognized, but the evaluators agreed the system recognized the obscured target plate better than they had expected. The evaluators also noted that the missed plate captures and incorrect recognition occurred when the system-equipped and/or the target vehicles were traveling at high speeds. The

evaluators felt that the combined time for plate capture, recognition, checking databases, and delivering alerts was fast, allowing officers to quickly validate an alert and, if necessary, pursue the vehicle in question.

The PAGIS system allowed users to manage multiple data files as individual databases, which the evaluators felt provided flexibility for managing unique data sets. More specifically, the evaluators found the ability to enable and disable all or some of the databases, as well as the ability to prioritize the databases for searches and alerts, to be useful. System administrators can track and restrict user access to the system and various features by establishing user names and passwords, a process the evaluators found to be easy and useful.

The evaluators also found manually entering license plates to be easy, although one evaluator would have preferred fewer steps in the process. The PAGIS system does not allow users to adjust image resolution or file size, but the evaluators indicated that adjustable image resolution would be useful. The PAGIS system tracks the latitude and longitude where every plate capture occurs; however, the evaluators indicated location coordinates would be most useful if displayed on a map. Mapping software that displays the coordinates on a map can be integrated with the PAGIS system, but was not installed with the assessed system. One evaluator favored the system's ability to report on a user-defined text field, while others would have preferred in-car reporting to include a wider selection of statistics to choose from than what was available.

Usability

The evaluators agreed the PAGIS system suited their usability needs. They felt that the interface provided features officers need to determine alert responses with minimal distraction from driving. Of particular note was the ability to select the color and data displayed for alerts based on record type. For example, a stolen vehicle alert can be one color and a stolen plate alert can be a different color. In addition, the evaluators found the system's user interface to be uncluttered, well-organized, and easy to use. Some evaluators, however, felt functions could be completed with fewer steps. All of the evaluators agreed that the PAGIS system started up and shut down quickly, and found the "hello" and "goodbye" audible indicators helpful in confirming the completion of both actions.

Deployability

Overall, the evaluators felt that the PAGIS system met their deployability needs. Although the processing unit occupied too much space in the trunk, the evaluators agreed the unit was sufficiently sealed and mounted for protection against extreme temperatures and jostling during high-speed driving. In addition, some evaluators noted that the cameras interfered slightly with the light bar; however, they liked that the cameras were small enough to be somewhat inconspicuous. The evaluators agreed that the cameras appeared to be sufficiently durable to withstand environmental conditions.

Maintainability

The PAGIS one-year warranty was considered by the evaluators to be sufficient and consistent with industry standards.

4.2 Mobile Plate Hunter 900 (MPH-900) by ELSAG North America

Pros	◦ Accurate plate recognition ◦ Fast combined time for capture, recognition, and alert
Cons	◦ Low rate of plate captures ◦ Limited configuration options for multiple databases ◦ Large, conspicuous cameras

The MPH-900 system received the second highest overall score, 4.0. On average, the evaluators agreed that the system's performance, features, and equipment made it a useful law enforcement tool. The MPH-900 was installed on a Ford Crown Victoria and was configured with a dashboard-mounted touch-screen monitor with keyboard and three cameras mounted on the trunk. Each camera had an integrated processing unit.

The following sections, broken out by SAVER categories, present the evaluators' written and verbal feedback.

Capability

Overall, evaluator feedback regarding the MPH-900's capabilities was favorable. Although the MPH-900 missed 16 out of 48 possible target plate captures, the evaluators noted that the system correctly recognized 31 of the 32 plates the system was able to capture. The evaluators indicated they would prefer a higher rate of plate captures, but considering all the missed plates were atypical plate types (flat or with partially obscured characters), the evaluators felt the system performance was acceptable. The evaluators determined the combined time for plate capture, recognition, checking databases, and delivering alerts was fast enough for officers to pursue a vehicle in question, if necessary.

The evaluators felt the MPH-900 would be more useful if users could customize alerts and enable, disable, and prioritize multiple databases. Some evaluators felt the system's login and password setup offered sufficient administrative control, while others wanted a greater level of control for assigning and limiting user access. Finding the navigation to and from the manual plate entry screen cumbersome, some evaluators suggested the task would be simpler if done in a pop-up window accessible while conducting other tasks, such as plate searches. Although the MPH-900 records latitude and longitude of vehicles when their plates are captured, the evaluators indicated that location coordinates are of little use to officers in the car unless displayed on a map. A feature for displaying coordinates on a map was not available at time of assessment. The evaluators indicated that the ability to generate reports from the mobile unit was sufficient, but they would have preferred a wider selection of statistics on which to report.

Usability

The evaluators generally agreed that the MPH-900 was suited for their usability needs. Evaluator comments regarding alerts were mixed. While evaluators found the spoken alarm type and the data presented with alerts to be useful, most indicated they would prefer more options for distinguishing alert types from one another. The evaluators indicated that the ability to adjust the brightness and contrast of the visual display was helpful. They added that the visual display would be more useful if views from multiple cameras could be displayed. In addition, evaluators would prefer the captured license plate image and corresponding system-read plate characters to be displayed more logically in relation to each other. The evaluators felt that the system's features were somewhat easy to use; however, they agreed that officers could work more

efficiently if fewer steps were required to perform functions and the buttons were more logically organized on the screen. Although all the evaluators agreed that the MPH-900 started up and shut down quickly, one evaluator would have preferred the software to automatically start when the car is started, noting that the MPH-900 icon was difficult to locate on the dashboard mounted touch screen.

Deployability

Overall, the evaluators felt that the MPH-900 met their deployability needs. Evaluator opinions varied widely regarding the camera-integrated processing units. Some of the evaluators favored not having to use trunk space to store the processing units, while others were concerned that the obtrusive camera size, due to the integration of a processing unit, would prohibit covert operations. Some evaluators also noted that the space savings in the trunk had little significance, because the MPH-900 requires a junction box to be mounted in the trunk. The junction box supplies power to the cameras and connectivity from the cameras to the user interface computer. One evaluator cited concerns that the processing units, although enclosed in the camera housings, might be more exposed to weather outside the trunk than they would if mounted inside the trunk. Although the evaluators perceived the cameras fastened to the vehicle's trunk to be highly durable, the evaluators noted that the cameras' magnetic mounting harnesses and wires might be targets for vandals.

Maintainability

The MPH-900 one-year warranty was considered by the evaluators to be sufficient and consistent with industry standards.

4.3 PlateScan by Civica Software

The PlateScan system scored third overall, 3.5. The evaluators frequently commented that PlateScan was easy to use; however, they felt the system did not capture or accurately recognize as many plates as they would have preferred. The system was installed on a Ford Crown Victoria and was configured with a dashboard-mounted touch-screen monitor, a trunk-mounted processing unit, three light bar-mounted cameras, and a camera inside the rear window. The light bar-mounted camera model the vendor provided for the assessment is being replaced with a different model for current and future installations, which prompted the evaluators to express concern that evaluation of this system would be limited in relevance.

Pros	◦ Efficient user interface minimizes driver distraction ◦ Flexible alert configuration and control ◦ Easy manual plate entry
Cons	◦ Inconsistent ability to capture and accurately recognize plates ◦ No security settings to restrict user access ◦ Poor image quality

The following sections, broken out by SAVER categories, present the evaluators' written and verbal feedback.

Capability

Overall, the evaluators considered PlateScan's capabilities to be acceptable. The PlateScan system missed 14 out of 48 possible target plate captures and correctly recognized 27 out of the

34 plates that were captured. The evaluators noted that the system was inconsistent in its ability to capture and accurately recognize target plates.

The PlateScan system functions with multiple databases. The evaluators found this capability to be advantageous for helping officers easily identify a record type when the system generates an alert for a captured plate matching that record. Most of the evaluators, however, indicated they would prefer to have the additional capability to enable, disable, prioritize, and search individual databases. The evaluators found manually entering license plates to be easy. They found the PlateScan's lack of user setup options prohibitive for controlling user access. The evaluators felt that PlateScan delivered fuzzy vehicle overview and plate images and commented that it would be helpful if the system had features that allowed users to adjust image resolution. One evaluator noted fuzzy images made it difficult to identify the plate's issuing state, which is critical to verifying system alerts. As with the other assessed systems, the evaluators found PlateScan's ability to record latitude and longitude of each plate capture location to be limited without a map display, which is not available for the user interface. The evaluators indicated that the system's reporting options were only marginally useful because the system does not track user statistics, and the user interface does not allow users to save report results.

Usability

The evaluators generally agreed that the PlateScan system was suited for their usability needs. Evaluator comments about PlateScan's user-interface were very positive, highlighting its exceptional ease of use, simplistic and logically organized graphics (e.g., buttons for user functions), and flexible sound control for alerts. Specific to camera views, the evaluators found the ability to select the number of camera views displayed and the ability to select the viewing mode (i.e., video, still, or infrared) for each camera view to be useful. Although the PlateScan system started up automatically when the computer was powered on, the evaluators agreed that startup was slower than they would prefer.

Deployability

Overall, the evaluators felt that PlateScan met their deployability needs. Although the evaluators agreed that the processing unit was mounted securely enough to keep it restrained during high-speed travel and sharp turns, there was concern that the size of the processing unit occupied too much trunk space. Most of the evaluators perceived the cameras to be durable enough to withstand outdoor environmental conditions; however, the general consensus was that the cameras interfere with the light bar and are large enough to draw unwanted attention.

Maintainability

PlateScan's one-year warranty was considered by the evaluators to be sufficient and consistent with industry standards.

4.4 CarDetector by Vigilant Video

Pros	• Relevant in-car reports • Low-profile camera design • Equipment uses minimal trunk space • Above-standard warranty duration
Cons	• No security settings to restrict user access • Poor image quality • Cumbersome operation • Non-ruggedized processing unit

The CarDetector scored fourth overall, 3.1. Although the CarDetector was considered to have good reporting capabilities and compact equipment, the evaluators indicated this product had poor picture quality and was cumbersome to operate. The system was installed on a Cadillac DTS and was configured with two roof-mounted cameras, a trunk-mounted processing unit for the cameras, and a free-standing touch-screen laptop computer, which also served as the processing unit for the database and user interface software.

The following sections, broken out by SAVER categories, present the evaluators' written and verbal feedback.

Capability

Overall, the evaluators considered the CarDetector system's capabilities to be acceptable. The system missed 9 out of 48 possible target plate captures, all of which were the partially obscured plate. The system correctly recognized 35 of the 39 target plates that were captured. Although most of the evaluators felt the system's recognition accuracy and ability to capture plates was acceptable, they found the combined time for plate capture, recognition, and alert to be too slow. For every captured plate, CarDetector attempted recognition multiple times and displayed data and images from each attempt on the user interface screen. The evaluators noted that the activity was distracting.

The evaluators felt the CarDetector would be more useful if users could customize alerts and enable, disable, and prioritize multiple databases. The CarDetector system can establish user identification by badge number for reporting purposes, but not for limiting user access. The evaluators preferred to be able to customize user access to certain features of the system. The evaluators reported that manual database entry was easy to use, but the on-screen keyboard was too small for fast input. The evaluators indicated that the image quality of the displayed plate captures was fuzzy. Evaluators would have preferred that the CarDetector have image adjustment features to improve readability of the captured plates. As with the other assessed systems, the evaluators found CarDetector's ability to record latitude and longitude of each plate capture location to be only somewhat useful without a map display, which is not available for the user interface. The evaluators agreed that the CarDetector reporting feature was highly useful, particularly the available statistics and the plate and vehicle pictures embedded in reports.

Usability

The evaluators generally found the CarDetector system was not well suited for their usability needs, emphasizing slow system startup, distracting visual display, poor image quality, and cumbersome operational tasks. In particular, the evaluators reported that the main screen was cluttered with graphics, features, and data, which they found distracting and unnecessary for critical tasks, such as monitoring the captures and responding to alerts for recognized plates. The evaluators found that accomplishing common tasks, such as configuring alerts, required too much navigation and took more time than they found desirable. In addition, the evaluators found

alert delivery to be slow and the order of images, data, and sound delivered with alerts to be confusing.

Deployability

The evaluators agreed that the CarDetector system was adequate for their deployability needs. They commented favorably on the low profile shape of the cameras since they did not interfere with the light bar and were somewhat inconspicuous. The evaluators also liked the compact size of the trunk-mounted processing unit for preserving trunk space. The durability of the processing unit was considered by the evaluators to be insufficient because it did not have a protective covering. The evaluators felt that the exposed wires and other vital parts of the unit could be easily damaged by extreme temperatures or by other equipment commonly stored in the trunk. The durability of the cameras was considered by the evaluators to be sufficient, but they felt measures should be taken to protect cameras from theft or detaching from the vehicle at high speeds.

Maintainability

The CarDetector's two-year warranty was considered by the evaluators to be well above industry standards.

5. Conclusion

Representatives from the law enforcement community evaluated four mobile LPR systems. The PAGIS system by PIPS Technology scored the highest, followed by MPH-900 by ELSAG North America, and PlateScan by Civica Software. CarDetector by Vigilant Video received the lowest score.

Throughout the assessment, evaluators stated that, most importantly, a mobile LPR system should accurately recognize license plates and have a user interface with clear images and intuitive, quick access to alert verification features. They also felt that a mobile LPR system should have effective organization of graphics and user features, ability to configure user access rights, fast captures and alerts, and durable hardware.

Evaluator feedback highlighted the following recommendations for law enforcement agencies procuring mobile LPR systems:

- Compare various systems on the market.
- Visit law enforcement agencies currently using LPR systems to draw on their experiences with the system and with the vendor.
- Determine the vendor's ability and intention to support purchased systems.

Emergency responder agencies considering adding mobile LPR systems to their current set of resources should carefully consider each product's overall capabilities and limitations when considering the unique needs of their jurisdiction.

Appendix A: Assessment Criteria Descriptions

Assessment Criteria	Description
Affordability	
Initial System Cost	The base system purchase price, including all vendor-provided equipment and services necessary for the system to be fully operational. The initial system cost must include complete and successful system implementation.
Ongoing Maintenance Costs	The cost of maintaining the system after the installation or after the warranty period has ended. These costs include technical support, training, cleaning and replacing parts, and system upgrades.
Cost of Optional Equipment	The cost of equipment for enhancing the base system's capability and performance, not included in the base system purchase price. Examples of optional equipment, typically the vendor's proprietary products, include additional cameras, mounts for alternative camera mounting, and database management software.
Cost of Required Software/Hardware	The cost of any software or hardware required to meet an LPR system's operational requirements, not included in the base system purchase price. Examples include a server to support database management software, database software such as SQL to support the system's database, or equipment to support connectivity between a server and system-equipped vehicles.
Volume Discount	Vendor-offered discounts with the purchase of multiple units.
Capability	
System Accuracy	The ability of the software to accurately identify license plate codes captured by the cameras and provide accurate database matches. If a system returns inaccurate information, a plate could be missed or the wrong vehicle could be pursued.
Alert Time	The combined time a system takes to capture a plate, perform the recognition process, check records for matching plates, and display a match. A system must process captured plates and alert users to database matches quickly enough to apprehend the target vehicle.
Plate Reading Conditions	The various conditions under which a system can effectively read plates. A system should read plates in all lighting conditions and in adverse weather without degradation. For this assessment the weather conditions were mostly sunny.
Field of View	An area in which a camera is configured to capture vehicle plates (e.g., parked cars on the right or oncoming traffic). A system should be configured with enough cameras to capture plates in multiple fields of view.
Operating System Compatibility	The ability of a system's software to be compatible with an onboard mobile computer's existing operating system (e.g., Windows operating system).

Assessment Criteria	Description
Speed Differential	The combined traveling speed of an equipped vehicle and a target vehicle. A system should have the ability to effectively capture and recognize plates when either the equipped or the target vehicle is traveling at high speeds or when both of them are traveling at high speeds.
Multiple Database Query	A system's ability to search multiple databases for plate matches. Multiple local, regional, and national agency databases contain license plate and crime information, and many agencies create their own targeted databases, such as those containing information about sexual predators or stolen vehicle hot lists.
Location Detection	A system's ability to log the latitude and longitude coordinates of every captured license plate. This feature tracks the travel path of wanted vehicles. Location coordinates are more useful when they are displayed graphically.
Processing Unit Networkability	The computer processing unit's ability to be connected to a network. A system's processing unit should be capable of connecting to a network via multiple methods (e.g., USB drives, wireless broadband, and cellular) to send and receive database information. The flexibility to work with multiple connectivity options allows an agency to implement more effective network connectivity as budget constraints allow.
Manual Database Entry	A user's ability to type license plate information into the system to search for vehicles on-the-fly (e.g., AMBER Alerts and apprehending persons fleeing crime scenes). Manual plate entry is also used for entering correct plate information when users discover a captured plate has been misread.
System Security	Features agencies can set or customize to safeguard against certain actions. Examples include features that can be set to require user logon and password and that can be configured to limit user privileges to certain system functions.
Statistic Reporting	A user's ability to produce reports directly from the mobile unit. A system should give users the ability to select data on which to report. Reports such as user shift activity, user actions taken on alerts, and activity per license plate are useful.
Database Management Software Availability	Vendor-offered, proprietary database management software that agencies can use to manage (e.g., merge, prioritize, query, and report on) database files. The group agreed that, depending on an agency's size, budget, and number of vehicles with installed systems, database management software could be used to enhance operations, demonstrating a more significant return on investment.
Data File Formats Supported	Industry-standard data file formats supported by an LPR system.
Configurable Images	A user's ability to configure the size and resolution of captured images. Reducing image size could alleviate issues with transferring data to and from database servers, as well as database storage issues.
Database Hit Notifications	A system's ability to support sending text, e-mail, and phone notifications about certain captured data to remote recipients (e.g., working with outside agencies to perform a particular investigation).
System Power Consumption	The amount of power required to operate a system's equipment, such as the cameras and processing unit.
Usability	
Visual Display	The information and graphics that are displayed by the LPR software, how they are organized and accessed, and an agency's ability to configure the display.
Alert Information	An agency's ability to configure how alerts appear and sound, how they are categorized, and how the associated information is displayed.

Assessment Criteria	Description
User Friendly Interface	A system's user interface that enables users to respond quickly to database matches by requiring minimal clicks and intuitive access to user actions.
Character Estimation	A system's ability to make a logical determination about plates that have some obscured characters and display the possible license plate codes, clearly noting that they have been estimated. This criterion is sometimes referred to as fuzzy logic.
Ease of Startup and Shutdown	A system's ability to start up and shut down quickly with minimal or no user intervention.
Training	Vendor-provided training and training aids.
Deployability	
Integration with Existing Car Systems	A system's ability to integrate with existing car computer systems (e.g., onboard mobile computer) and associated electrical system connections. This criterion refers to core computer system integration and is different from integration with in-car cameras, which would be used to capture additional plates.
Processing Unit Durability	A processing unit's ability to withstand extreme weather and rugged handling, especially when the unit is located in the vehicle trunk.
Camera Durability	A camera's ability to withstand direct weather exposure.
Camera Size	A camera's potential to interfere with other equipment, such as a light bar, due to the camera size. For covert operations, camera size may also be a consideration.
System Portability	A temporarily mounted system's ease of setup and removal and a permanently mounted system's ability to be removed from an old car without degradation and be preserved for installation on a new car.
Camera Mounting	Camera mounting apparatus that ensures cameras are safely attached to the vehicle and do not interfere with existing equipment.
Processing Unit Size	A processing unit's potential to interfere with other equipment and occupy areas in the vehicle where available space is limited.
Integration with In-Car Cameras	A system's ability to capture an additional set of plate images with an in-car camera can be advantageous; however, an in-car camera's limited ability to provide high quality images necessary for recognition and the reduced recognition speed that may result from analyzing an additional set of images is a potential disadvantage.
Maintainability	
Customer Support	A vendor's commitment to provide support to an agency for successful system implementation and throughout the duration of the agency's ownership of the system.
Warranty	A vendor-offered warranty that covers all equipment, parts, software, and any associated labor.
Backwards Compatibility	Vendor assurance that new software versions will be compatible with existing operating systems, software, and equipment.

Appendix B: Score Calculation Methodology

Using the evaluators' ratings, the overall score for each product was calculated based on the assessment criteria and SAVER category values established by the focus group. The process for determining overall product scores began with calculating an average rating for each criterion by summing the ratings provided by each of the evaluators and dividing it by the number of responses. A weighted SAVER category score for each product was also calculated by multiplying the average criteria rating by the assigned weight. The sum of the weighted average scores in a category was divided by the sum of the maximum product scores in the category to arrive at the category score, as seen in the formula below. The percentage result was then normalized to represent the category score on a 1 to 5 scale.

Category Score

$$\frac{\sum(\text{Average Criteria Rating} \times \text{Weight for Each Criteria})}{\sum(\text{Max Product Rating} \times \text{Weight for Each Criteria})} = \text{Category Score}$$

Using the PIPS Technology PAGIS system as an example, the following formula demonstrates how the deployability category score was calculated.

$$\frac{(4.75 \times 5)+(4.25 \times 5)+(4.25 \times 3)+(3.75 \times 2)}{(5 \times 5)+(5 \times 5)+(5 \times 3)+(5 \times 2)} = 87\% \text{ or } 4.4 \text{ (on 1 to 5 scale)}$$

To determine the overall score for each product, each category score was multiplied by the category percentage value. The results for each category were summed to arrive at the overall product score as seen in the formula below. Percentage values originally assigned to the five SAVER categories by the focus group were normalized to total 100% because the affordability category was excluded from this assessment.

Overall Product Score

$$\sum(\text{Category Score} \times \text{Category Percentage}) = \text{Total Product Score}$$

Using the PIPS Technology PAGIS system as an example, the following formula demonstrates how the overall assessment score for the product was calculated.

Capability		Usability		Deployability		Maintainability		Total Product Score
(4.5 x 42%)	+	(4.6 x 29%)	+	(4.4 x 19%)	+	(3.5 x 10%)	=	**4.4**

This process was repeated for each of the remaining products.

ANNEX B

Company Survey

Chart A

	COMPANIES			
QUESTIONS	**Gentec Inc.**	**PIPS Technology**	**Coban Technologies Inc.**	**Plate Scan**
What applications do you have for the LPR Technology?	fixed, mobile and back office reporting/data mining	PIPS Technology has systems in place in a variety of applications including public safety, surveillance (covert and overt), access control, commercial vehicle enforcement and weigh station applications, open road tolling, travel time measurement, parking enforcement, and a number of others.	Both-In car & backend storage & management software.	We do both license plate recognition and back office data management.
What camera technology does your company use?	Infared color camera	Infared color camera	Front facing IRC camera for lane scan & side-facing for parking lot scan	We can read license plate through both IR and color cameras. This dramtically expands our ability to read plates that might be missed by the use of IR alone.
How does your product intergrate with current MDC's or does it need a separte computer.	our application runs in the background on the mdc.	PIPS Technology's data transfer protocol is standard TCP/IP and generally integrates with most MDC environments. VPN software could block port traffic from LPR computers to MDC computers. Usually VPN software providers can provide rules to allow for this to happen.	Coban ALPR software runs on Coban TopCam-II & VMDT-II systems as well as certain laptop computers.	We integrate with existing MDCs.
Does your platform have data mining? If so what data is captured and how can it be retrieved	yes. LPR overview (license plate), color overview, time/date/location (gps and mapping required)	The PIPS vehicle record consists of a color image of the vehicle, infrared image of the license plate, interpreted license plate read, date and time stamp, GPS coordinates and/or location identification, a unique transaction identifier, and more. The data may be retrieved by querying via PAGIS (in vehicle GUI) or BOSS (Back Office Software Server). Our Boss software is unique in that it allows for easy data sharing among neighboring agencies that use the PIPS system (currently or in the future). PIPS Boss software also integrates data from our fixed and mobile LPR systems.	Yes, our backened application stores scanned plates & GPS coordinates of each plate.	Yes. The data captured includes pictures of the plate and the vehicle, the time, date and GPS locations as well as any dtat that can be gathered from other sources, such as Records management systems, etc.
Does your platform also take pictures of the vehicle when it scans it?	yes	Yes, color overview images.	Yes	Yes.

QUESTIONS	Gentec Inc.	PIPS Technology	Coban Technologies Inc.	Plate Scan
Does the platform match car color and partial license plates for hits?	no, but there is a color overview picture	PIPS applications can query based on partial license plate information. Car colors are not recorded as there are ineffeciencies with this analytic. The color overview if provided so that the user may visually verify color, make and model of the vehicle of interest.	Car color is not used for searches. Partial plate search is supported.	Yes on partials and no on color from the camera. If you have registration information, such as from DMV, we can include that in our back-office system. (Any system that tells you it can determine car color from their cameras is not telling the truth.)
What databases does your product work with?	Can provide a Software Data Kit (SDK), if needed.	Microsoft SQL	Access database for car. Microsoft SQL Server is used in the backend for capacity & performance.	The primary system is MS-SQL, however, we can interface with othe.
Does your platform work with IMS hierarchy databases?	No	PIPS Technology prefers not to work with IMS databases. IMS is not an off the shelf product and therefore would require resources and development.	No	Our own solution "PlateScan backOffice" uses standard ODBC / TSQL (Mircosoft SQL) for its primary data storage methods. However, we do export a generic/standard XML file that would allow the data to be easily integrated with an IMS hierarchy model. Each individual "read" of a license plate/Tag would be a single record and would easily confirm to standard single table format.
What applications are used for the fixed LPR software?	same as the mobile	PIPS Technologies fixed ALPR devices feed back to the BOSS server and allow for data mining and retrieval just as mobile systems.	Does not offer fixed LPR solution directly, however, our ALPR technology provider, CitySync, is a leading UK-based fixed-LPR technology provider.	Works the same as mobile.

Chart A

QUESTIONS	Gentec Inc.	PIPS Technology	Coban Technologies Inc.	Plate Scan
What makes your platform better than other LPR platforms?	processing is done in the camera, no need for cpu in the trunk and integrates with Omnicast.	PIPS Technology is the most accurate LPR system on the market, in addition to read accuracy, usability, data structure and durability. We were recently evaluated by the DHS SAVER Program. Report is available through a website. We have also included the California Highway Patrol's PIPS test results for your review. These are 2 of 3 independent test results where PIPS accuracy has been validated over 90%. No other LPR vendor has been able to achieve this benchmark.	Cost-effective & affordable, Easy to install, easy to use, intergrate w/Coban video systems.	High accuracy rates, ease of use, powerful back office
Does any of your products intergrate with the Coban digital video by turning on video camera automatically.?	SDK or API can be provided	Not sure of level of integration you are discussing with Coban. We have internal settings that can operate or trigger many different devices provided we are given access to them. We do have technical contacts with Coban and can easily reach out to them for this to be achieved.	Yes	Yes, our system has been tested to work with Coban's.
How will troubleshooting and updates be handled?	through our channel partners if not sold direct.	PIPS has a customer service phone number and email address for first line resolution. We also have a repair/replace warranty and maintenance programs.	1 year warranty, extended warranty covers tech support, free hardware replacement & software updates.	Software managment can be handled remotely. Hardware issues will either be by RMA or on-site.
What is the largest police department account?	Chicago PD or Los Angeles PD	Los Angeles Sheriff's Department, Jefferson Parish Sheriff's Department, Cincinnati Police Department, Chicago Police Department, California Highway Patrol are all large deployments (or very soon to be).	New application. Pilot accounts in Houston.	Houston, TX PD. And Los Angeles, CA PD

QUESTIONS	Gentec Inc.	PIPS Technology	Coban Technologies Inc.	Plate Scan
Does your product know the difference between states?	no, but version 4.4 will include this ability.	PIPS Technology will perform state recognition using the IR plate image and resulting read through the use of regional syntax and font rules. This regional approach will include the border country, the state in which the system is located, and all adjacent states (each region will be defined in conjunction with the agency based on their understanding of typical vehicle populations expected at the various locations). For example, a site in Texas would use a regional state recognition engine to include the U.S. states of Texas, New Mexico, Oklahoma, Arkansas, and Louisiana; and the Mexican states of Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. The regional OCR approach will maximize the accuracy of both the OCR read performance and the state recognition.	Yes, users can optimized the system for local plates.	In a limited area, yes. Again, any system that clams to be able to determine the state of every plate is not telling the truth.
What is the cost for a mobile system for a vehicle	$15,000 with installation/training	Costs range from $14-27k with a one time purchase of the Boss software.	$12,400 for each in-car system (2 cameras, frame grabber, Ethernet hub) does include installation, training , & server side installation/ configuration.	Ranges from $5,000 to $23,000, depending on the array of cameras
What is the cost for a fixed system	same as the mobile	Fixed systems vary depending on application, location, # of lanes (cameras) integration and involvement. We would need to have an understanding of what the project entailed to provide a cost. Typically this requires a site survey of each location, a meeting with your I.T. department to discuss data requirements, data flow, current infrastructure, etc. We can provide law enforcement references for you to speak with regarding the internal and external issues they faced when deploying our system.	Too many factors, can pass info to CitySync for details.	Generally about $10,000 per lane, o. average
			This is our current video system.	

ANNEX C

City Survey

Chart B

Department	Company used	Pros	Cons	System use
Scottsdale, AZ	PIPS	View hundreds of more plates per hour.	Amount of infrastructure & technology setup that was needed to make it an effective product.	Routine patrol & dedicated Auto Theft Unit
Cincinnati, OH	PIPS	Helpful in mapping out locations where the plate has been recorded so officers know a concentrated area to look if vehicle is ever involved in a crime.	None	Warrant service & identifying stolen vehicles.
Tucson, AZ	PIPS	Identify any stolen vehicle, plate or warrant associated to the plate if entered in the system.	Will not read plates that do not contain enough reflective material to be recongized by the system.	Warrant service & identifying stolen vehicles.

Annex D

Closed 2007 ALPR project

MEMORANDUM

October 4, 2007

TO: Sergeant Karen True, Supervisor, Polices and Procedures Section

FROM: Officer Joshua Clevenger, Project Officer, Policies and Procedures Section

SUBJECT: Project #123, Automated license plate reader technology

This project officer was assigned the project of researching the automated license plate reading technology.

During the process, I found four major manufactures of the technology and developed a questionnaire to better understand the product and compare it to the other manufactures. During my research process, I was contacted by Sergeant Jay Pruetting of the Gang Unit and he wanted me to attend a demonstration from Pips Technology. It was determined at that time that funds could be allocated to the Gang Unit through the Kansas City Crime Commission from the Federal Prosecutors Office. I later contacted Barry Mayer, Kansas City Crime Commission and he stated that they did not move forward with this technology. I am placing the questionnaire and information that I received from the vendors and department members for later reference.

I am submitting this project for your review and approval.

Officer Joshua Clevenger
Policies and Procedures Section

uestions 2007	AutoVu	Civica	Intex	Pips Tech
t applications do you have for the LPR nology?	Mobile	Fixed, Portable, Mobile	Fixed,Portable, Mobile	Mobile, Fixed, Portable
t camera technology does your company	1 infrared; 1 color	use both infrared and color	IR Pulse, only 1 camera	Infred,color,OCR
does your product intergrate with current 's or does it need a separte computer.	needs separate computer but can integrate	Separate processor in trunk	Yes	Yes and separate processor in trunk
s your platform have data mining? If so what is captured and how can it be retrieved	yes and GPS, mapmatching	yes and the data is web based	Yes	Yes; wireless
s your platform also take pictures of the icle when it scans it?	yes	yes	Yes	Yes
es the platform match car color and partial nse plates for hits?	no	no	Yes/somewhat	no
iat databases does your product work with?	NCIC	NCIC	Sql/	Mules, NCIC
es your platform work with IMS hierarchy abases?	unknown	unknown	unkknown	It can
lications are used for the fixed LPR ftware?	Airports		acess control, data mining in regard to monitoring streets	BOSS product would alert communications center.
hat makes your platform better than other R platforms?	assemble own cameras, devolops own software, does two lanes of traffic on	read 4 cameras at a time, read from infred and color,	universal, the unit is transportable, and reads all license plates	Manuafacuter all parts of the software
es any of your products intergrate with the oban digital video by turning on video camera tomatically.?	Yes	Yes	Yes	no, but workable
ow will troubleshooting and updates be ndled?	over wireless networks	over wireless network	Over wireless network/telephone network	updates in disk or Lan, have a tech support

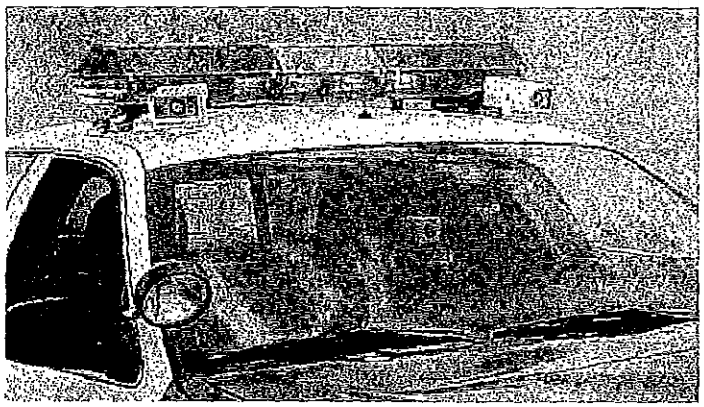
What is the largest police department account?	LAPD,San Diego, . Sacramento, Chicago	LAPD, Los Angeles Sherrif, Houston PD, Sacramento PD and Border Patrol, Reno PD	FBI	Calfornia HP, have 40 units and 5-6 fixed sites.
Does your product know the difference between states?	no	no	Yes	
What is the cost for a mobile system	$18,500 and $2000 install	4 camera system $23,000	$15,000	3 camera system, $25,000
What is the cost for a fixed system	not at this time	$8000 for 4 lanes	$20,000	$10,000 a lane

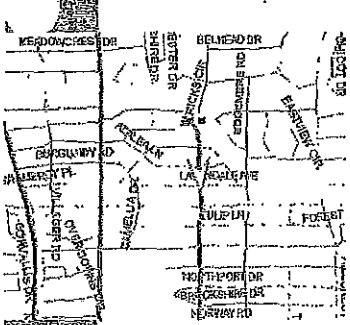
AUTOVU

AutoVu Mobile

for Law Enforcement

AutoVu Mobile is a proven mobile License Plate Reading (LPR) system that has been designed to automatically and accurately read the license plates of both moving and parked vehicles – either while driving, or when parked at the side of a roadway. AutoVu Mobile provides a unique and efficient means to automate the detection of wanted vehicles and to gather intelligence data.





AutoVu Mobile Description

AutoVu Mobile is the latest **patent protected**[1] technology breakthrough solution from AutoVu Technologies Inc. The system enables law enforcement officers to automatically read license plates from both moving and parked vehicles and match each plate to an on-board database of wanted vehicles.

The AutoVu Mobile system is outfitted with four cameras enabling simultaneous reading of license plates on both sides of the vehicle in addition to providing color overview images of each vehicle scanned.

AutoVu Mobile is the only mobile LPR system configured with proprietary real time positioning technology that provides accurate location information in cases where traditional GPS will fail – such as dense urban settings. Combining LPR with accurate positioning is critical for effective data-mining applications.

A comprehensive back-end management reporting system is provided.

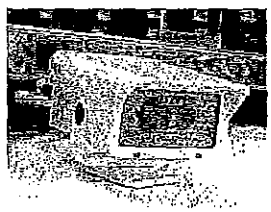
AutoVu Mobile Applications

- Wanted Vehicle Identification and Interdiction
- Data Mining and Intelligence Gathering
- Geo-fencing

1 United States Patent RE38,626

System Features

- Daytime and nighttime operation
- Font-independent reading at rates up to 60 frames per second per camera
- Reliable scanning of parallel-parked vehicles in typical urban settings even when vehicle spacing is limited. Also reads vehicles parked at 45 and 90 degrees
- Reading at differential speeds of up to 140 MPH
- Small image capture units including cameras and illuminators designed for permanent installation or magnetic mounting
- Color overview imaging cameras
- Rugged high performance 1.8 GHz Pentium-M processor based processing system designed for vehicular use
- Integration with existing Mobile Data Computer (MDC); alternately, a robust touch-screen interface is available



Product Options

AutoVu Mobile License Plate Reader / Data Mining Solution

- This system combines AutoVu's proven accurate LPR with our proprietary high-precision positioning technology
- Moving map display indicates the vehicle's current position
- Startup / shutdown integrated with vehicle's ignition
- Wireless data transfer capability for updating wanted vehicle lists and offloading records for data mining
- Complete back end data mining and management reporting system:
  - Plate search by time window, geographic window, or both
  - Sequential vehicle tracking – to follow the movements of a wanted vehicle
  - Management reports provide system usage and performance data (license plate scans, number of wanted vehicles found, playback of vehicle patrol route etc.).
- One-year repair and return warranty, limited telephone support with remote access for enhanced product support

AutoVu Mobile Portable License Plate Reader

- This system combines an LPR processor, two magnetic mount high performance image-capture systems, and a touch screen or MDC integration
- One-year repair and return warranty, limited telephone support
- Product options:
  - Enhanced GPS based location technology
  - Wireless data transfer capability for updating wanted vehicle lists and offloading records. (Also enables remote access for enhanced product support)

AUTOVU

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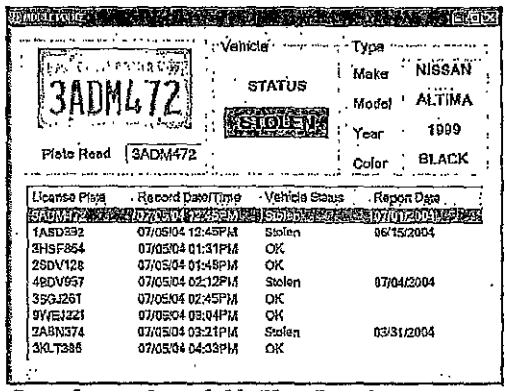
RAPID RESPONSE Plate Reader

INEX Technologies provides ALPR (Automatic License Plate Reader) systems for a wide variety of applications. And because INEX systems can operate without an external trigger device, it is ideal for a variety of police and enforcement applications. One very important feature is the ability to quickly (under 200 ms.) capture and read a license plate number and compare it to a list of vehicles of interest.

The *RAPID RESPONSE* system provided by INEX uses infrared illuminators invisible to the human eye making it ideal for covert operations. It can also be configured to operate from a 12v power source for vehicle installation.

The INEX Rapid Response *plate reader in action*



One of several available User Interface screens

A typical portable system designed to read the license plates of passing vehicles can be used from a stationary position or mounted on a vehicle.

The camera/illuminator is simply aimed toward the license plate of a target vehicle and the captured image is sent via a cable to a laptop for processing. The laptop is where the processing software resides and where a BOLO list can be kept. A wireless link can be used to interrogate a list kept elsewhere.

The entire system consists of a camera with built-in infrared illuminator plus power supply, and a laptop computer to host the software for finding the license plate in each image and perform the OCR process. For more information please email us at: info@inextek.com or visit our website: www.inextek.com.

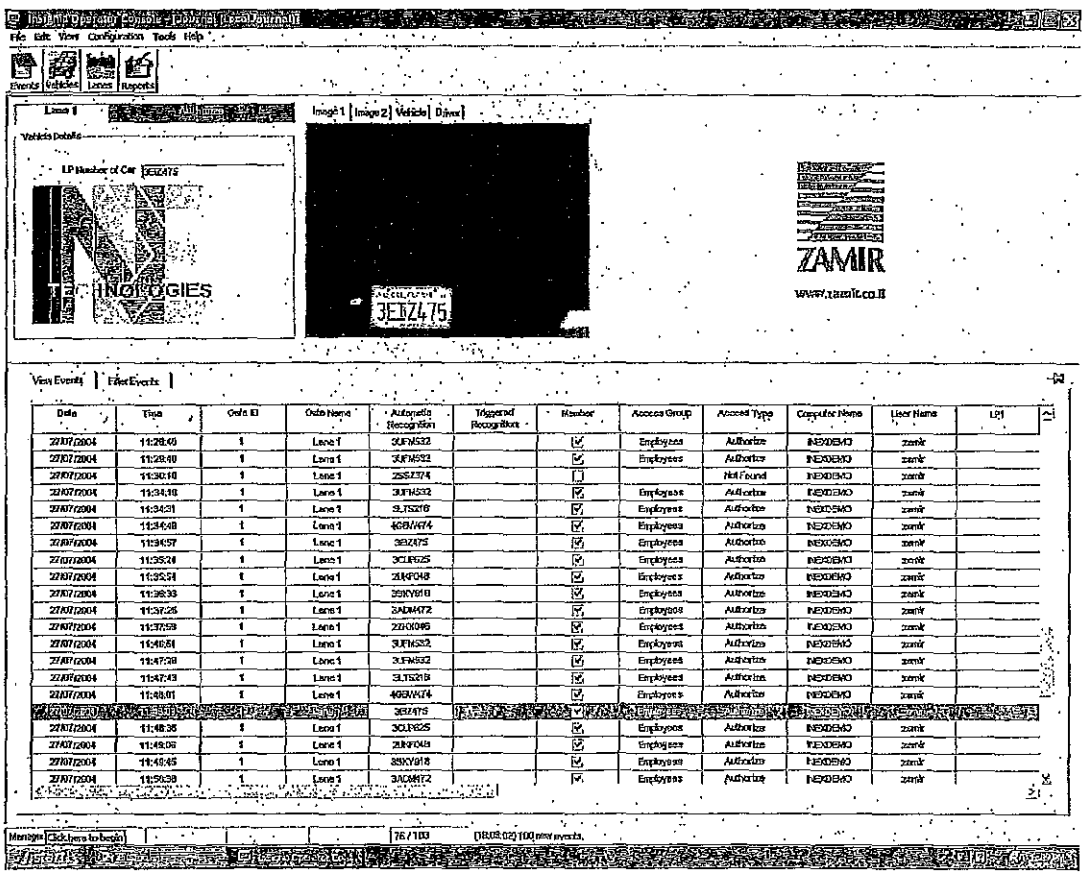
InSignia MANAGEMENT SOFTWARE

INEX offers software interfaces to compliment all the hardware solutions we offer. The primary interface to the Insignia 4 product line is the ***Operator Console***, which runs on Windows 2000/XP and provides a simple and convenient access to all the Insignia 4 units connected in a networked environment.

The Operator Console allows the user to view:

- Vehicle Events
- Vehicle Database
- Lane Status
- Reports
- Multiple images (vehicle, driver, license plate, etc.)

Each user logged into the system will have the privileges allowed by the system administrator whether to configure the system database, add users and set their privileges, add/modify vehicles and their access rights, define user rolls and their associated privileges, and more. INEX provides custom versions of the Operator Console as may be required to meet all customer requirements.



pips TECHNOLOGY

Automatic License Plate Recognition

the silent partner

LAW ENFORCEMENT SOLUTIONS

ALPR TECHNOLOGY for LAW ENFORCEMENT

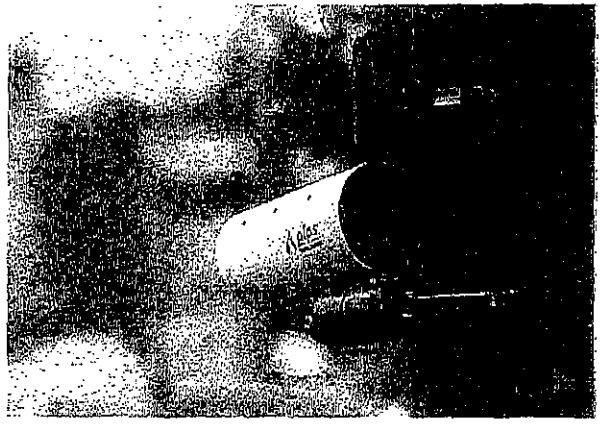
Automated License Plate Recognition (ALPR) from PIPS Technology is rapidly growing as an effective tool to combat criminal activity, enhance productivity and improve officer safety.

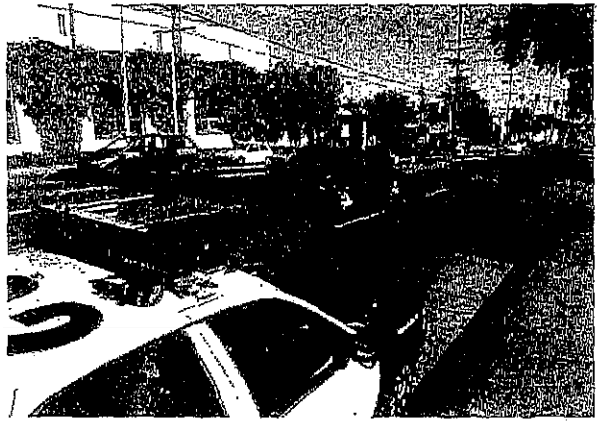
Local, state and federal agencies worldwide have adopted ALPR systems to improve the efficiency and effectiveness of their enforcement efforts.

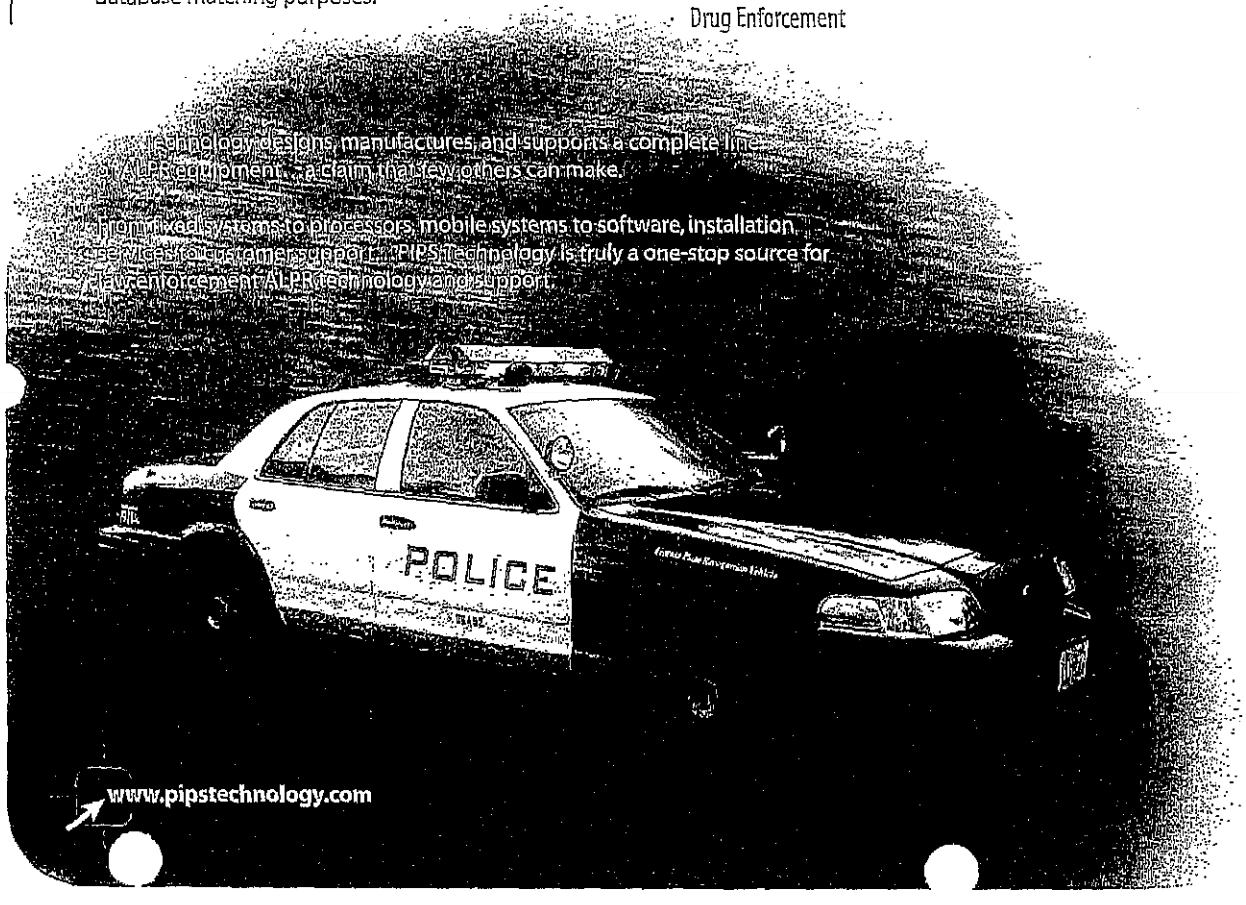
ALPR works day or night, and in adverse weather conditions, by using an infrared camera to capture images of plates. Using Optical Character Recognition, the plate image is then translated into text which can be used for database matching purposes.

APPLICATIONS

- Stolen Vehicle Recovery
- Identification of Felons or Wanted Individuals
- Monitoring School and Playground Perimeters for Sexual Predators
- Amber Alerts
- Identification of Delinquent Citations for Revenue Enforcement
- BOLO Suspects
- Crime Scene Intelligence and Surveillance
- Monitoring of Gang Activity and Locations
- Drug Enforcement







Using PIPS Technology as your source for ALPR will put you in good company. Agencies across the nation and around the world have adopted PIPS Technology as the standard for ALPR technology solutions.

With offices and support personnel in two US locations and one in Europe, PIPS Technology is always there to provide its customers with the support they expect and deserve.

BENEFITS

REVENUE GENERATION

Improve collection of unpaid citations and taxes by utilizing the system to identify vehicles with outstanding traffic and parking violations. When used for revenue generation, many agencies will achieve ROI in 90 days or less!

ENHANCED EVIDENCE and DOCUMENTATION

The system captures and stores a permanent record of everything it sees. The data is encrypted, automatically dismissing any claims of evidence tampering.

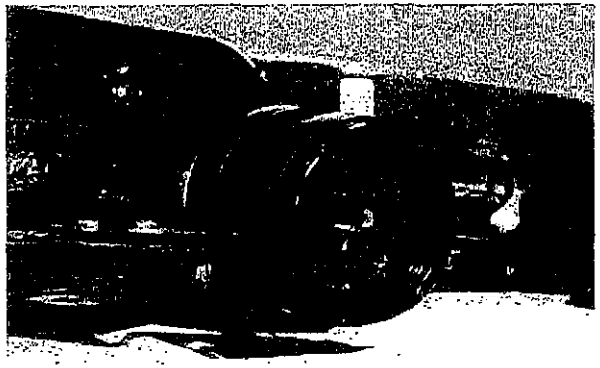
ELIMINATION of DISCRIMINATION CLAIMS

Because the system sees and reads every plate – not just those of suspicious looking vehicles or persons, discrimination claims may be laid to rest.

While ALPR technology is an investment, many customers find that it quickly pays for itself.

PIPS Technology is able to provide the highest quality equipment and service at a competitive price by configuring a system from its broad product range that best meets the client agency's needs.

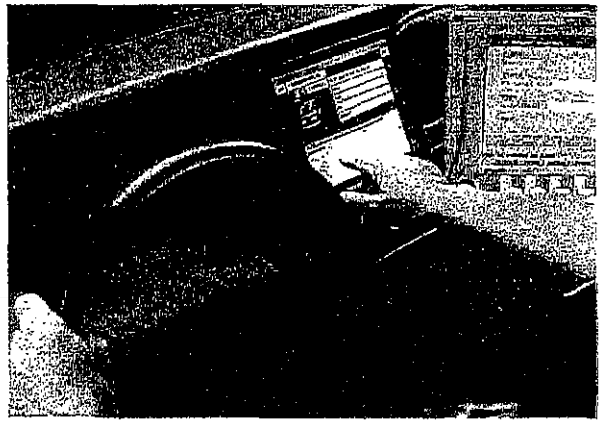
INCREASE PRODUCTIVITY



Each PIPS Technology ALPR system acts as a force multiplier…an aggressive officer could enter in a few hundred plates per day while the system is capable of logging thousands.

With remarkable capture and read rates, even **at vehicle speeds over 130 miles per hour**, the system **can check 3000 to 4000 plates per shift**, freeing up the officer for other duties.

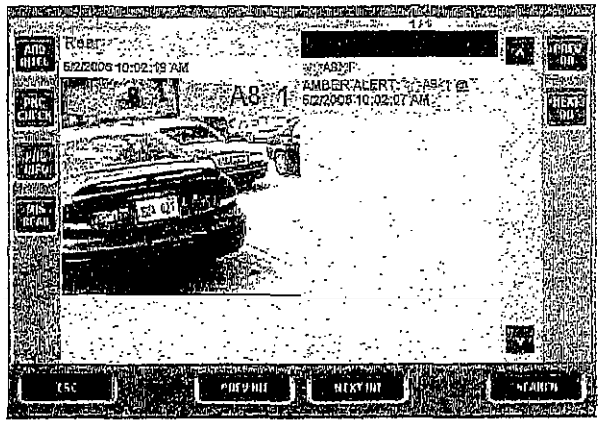
IMPROVE OFFICER SAFETY



The system provides historical data associated with a license plate.

By making officers aware of their surroundings and alerting them to potentially dangerous situations before they happen…ALPR can help to avoid conflicts and save lives.

BOOST IDENTIFICATION SPEED and ACCURACY



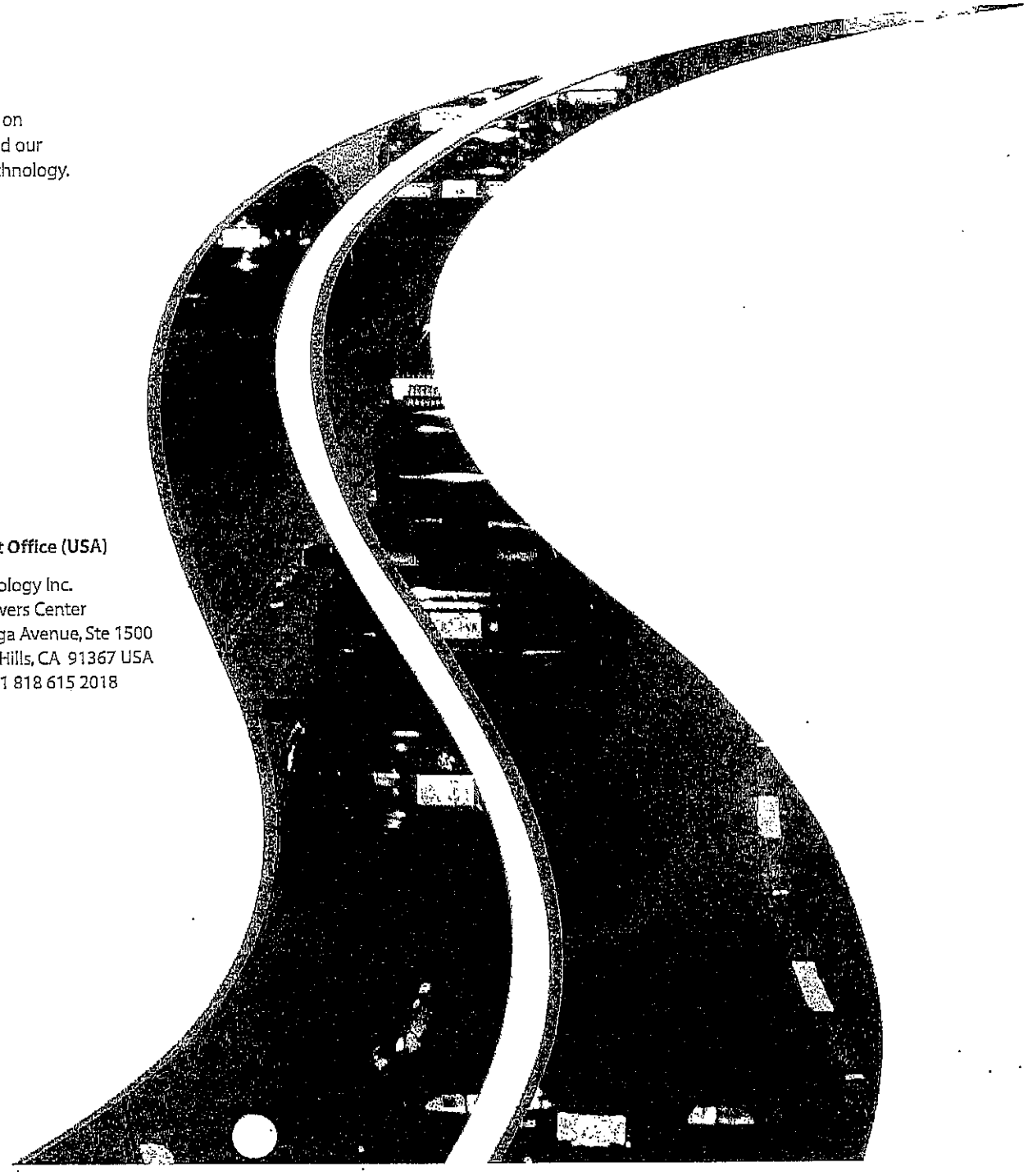
With PIPS Technology ALPR solutions, integration and accessing up-to-the-minute data is fast and seamless.

Databases can be easily maintained and new information can be quickly uploaded across all deployed units for improved enforcement with a PIPS Technology back office system

FOR MORE INFORMATION

Please call one of our offices or visit us online for details on PIPS Technology ALPR solutions for law enforcement and our complete line of automatic license plate recognition technology.

PIPS Technology...the most advanced license plate recognition systems in the world



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Case Study

Long Beach Police Departm
Long Beach, Californ

Mobile License Plate Recognition System

Following an extensive evaluation process, Long Beach Police Department acquired four (4) PIPS' mobile automated license plate recognition (ALPR) systems in December 2005. Despite other crime rates decreasing in Long Beach, auto theft rates have been on the rise for the past three years. The ALPR systems were acquired primarily to combat this trend.

The first six months have produced amazing results.

- **1.4 million plates read**
- **929 lost or stolen plates identified**
- **275 vehicle recoveries**
- **50 arrests**

"The ALPR system does not discriminate," states Sergeant Chris Morgan. "It almost eliminates any problems with profiling. The camera doesn't distinguish the color of a driver's skin or the condition of the car."

LBPD Sergeant Chris Morgan

Stolen Vehicles

An LBPD officer received a stolen vehicle alert from the ALPR system. The Night Auto Theft Detail set up surveillance on the stolen vehicle until the suspects arrived. An arrest was made and five high value cars were recovered.

Drug and Identity Theft

A stolen vehicle alert notified an LBPD officer that the suspect traveling in the vehicle should be considered armed and dangerous. Surveillance was established on the vehicle, the suspect was followed to an apartment where an arrest was made. Large amounts of methamphetamine, marijuana, and identity theft profiles were recovered.

Carjacking

An off-duty officer was the victim of a carjacking with limited information on suspects. After the ALPR system identified another stolen vehicle, surveillance led the LBPD Career Criminal Apprehension Team to identify the suspect as the perpetrator of the carjacking. An arrest was made.

For additional information about this and our complete range of ALPR products and traffic technology solutions, call or visit us on-line.

www.pipstechnology.com

PIPS Technology
the most advanced license plate r nition systems in the world

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