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# How New Parking Technologies Help Law Enforcement Fight Crime, Control Traffic, and Boost Revenues

By Richard B. Easley, CAPP, President, E-squared Engineering, Ashburn, Virginia; and Thomas Wunk, CAPP, Vice President of Operations, Scheidt & Bachman USA Inc., Linthicum, Maryland

For police officials, parking is rarely considered in the frontline fight against crime. Yet, in recent decades, parking lots and tickets have figured prominently in several high-profile criminal cases.

During the trial relating to the 1993 World Trade Center bombing, video from the tower parking garage was used as evidence to convict terrorist mastermind Ramzi Yousef. That same year, Aldrich Ames, a CIA agent spying for the Russians, was arrested after law enforcement tracked his movements and parking patterns using his access control card for the CIA parking lot. In 1977, police caught serial killer David Berkowitz, "Son of Sam," who terrorized New York City and killed 6 people in 12 months, after tracking down a parking ticket issued to his vehicle at the time and near the place of one of the murders. Each one of these cases used the parking technologies available at the time to assist in fighting crime.

Today, technologies in the parking industry are revolutionizing parking operations. These technologies are tools that can be used to prevent crime or as evidence after a crime.

## Preventing Crime with E-payment

One of the most important technological advances in parking is the movement away from cash payment to e-payment: funds exchanged electronically using computer networks, the Internet, and digital storage systems. Just as the replacement of cash payment with credit card transactions at convenience stores and gas stations helped reduce crime in those environments,<sup>1</sup> the replacement of cash with e-payment in parking facilities is a positive development from a crime prevention perspective.

Increasingly, parking operators are installing payment systems that accommodate credit cards, other cards that carry balances, and even cell phones that access e-payment accounts or possess credit card capability with an electronic chip on the subscriber identity module (SIM) card. E-payment makes the lack of cash available on-site far less attractive to criminals.

E-payment also provides auditing capabilities to track the movement of criminals.

## Using Automatic License Plate Recognition

License plate recognition (LPR) is an automated vehicle identification technology utilizing specialized cameras and software to recognize license plates, capture tag images, and transform the numeric and alpha characters on a license plate into a common format data stream. For many municipalities, universities, airports, medical centers, shopping malls, military bases, and corporations, LPR technology is typically used to confirm vehicle access to parking facilities. For law enforcement, LPR is a valuable technological tool for identifying vehicles of interest in crime investigations and for parking enforcement.

In Cincinnati, for example, the police department was able to locate a vehicle, set surveillance, and wait for an armed robbery suspect to arrive—all because LPR technology in the city's mobile systems had captured images of the suspect's vehicle parked on the street. In another example, the University of Kentucky's Parking and Transportation Services (PTS) department installed its LPR system on a parking control vehicle, which locates vehicles that have outstanding parking violations. Within 40 minutes, the system can read more than 2,500 license plates. During one sweep, the system was able to locate 5 vehicles with a combined 15 outstanding parking violations. In the long term, the university has the option of using the system to identify stolen vehicles or vehicles that have exceeded the time limit at time-enforced parking locations.

At several large airports and municipal facilities, law enforcement officials are working with parking operators to use LPR technology to track stolen vehicles and identify vehicles of interest in crime investigations. In these locations, the parking operator gives law enforcement officials access to its LPR databases and, in essence, becomes an extension of the public safety system. As costs for LPR systems continue to decrease,

more LPR systems will be installed, providing new opportunities for parking and police officials to work together to fight crime and improve security.

## Other Vehicle Identification Technologies

In addition to LPR, there are several other automatic vehicle identification technologies in use in parking facilities and toll road processing—all with potential law enforcement applications. These include the use of radio frequency identification (RFID) tags, bar code tags, and transponders. Several major universities and the military use RFID to control vehicle access to their parking facilities and track the institution's vehicles as they travel outside the campus or military base.

Wireless sensing devices also are able to perform vehicle recognition (using general size and shape) and aid in revenue generation from parking violations. Combined with accurate GPS data, wireless sensing devices automatically detect and notify parking enforcement officers of unmoved vehicles. They also are equipped with cameras that can take photos of the violations. The city of Fredericksburg, Virginia, had limited parking, which resulted in street congestion, so the city used this technology to manage parking supply and determine when an escalation of enforcement was needed. In this case, violators first received a warning, followed by a ticket with a photo of the vehicle if there was any further violation. Using this device, officers could patrol the same area in 40 minutes compared to the pre-system patrol time of 5 hours. Benefits included an overall revenue increase as well as an additional 4 hours and 20 minutes of law enforcement capability.

Other on-street technologies used to enforce parking restrictions include handheld units, which have replaced pads and pens, and in-ground sensors that can detect how long a vehicle has occupied a space.

## Preventing Crime with Better Lighting

Lighting fixtures in parking facilities are universally considered to be the single most important parking security feature. Good lighting deters crime and produces a more secure environment for the public and the operators. As a key component of the security system, lighting fixtures must be reliable and provide ample, glare-free illumination. They must also be able to withstand the elements and be protected from vandalism.

Many parking facilities have replaced incandescent lighting and high-intensity discharge (HID) lighting with fluorescent fixtures to illuminate parking stalls and driving lanes. These lights reduce energy consumption by 30 percent to 85 percent at equal or greater light levels. From a crime prevention standpoint, they have the benefit of instant illumination and remain brighter longer. Coupled with closed-circuit

television (CCTV) equipment, they provide improved color spectrum and contrast.

Each year, more than \$1.5 billion is made available by utilities and government agencies to help offset the cost of energy-saving projects, including those involving lighting. The National Energy Policy Act allows a tax deduction for energy conservation measures that reduce energy demand by 50 percent or more. These and other economic incentives are spurring development of other lighting advances, including light-emitting diode (LED) fixtures. LED technology has the advantage of instant “on,” brighter lighting, longer life than other lamp sources, reduced maintenance, and energy savings. However, LED lighting is one to three years from becoming mainstream in parking facilities because standard construction cannot handle the thermal challenges of LED lights, and the optical design in most traditional fixtures does not maximize LED’s efficiency. Still, once lighting industry experts learn how to capitalize on LED technology, these lights will aid crime prevention in parking facilities.

### CCTV for Crime Prevention

In recent years, an increasing number of parking facilities have installed CCTV to monitor pedestrian and vehicle traffic. This technology, which uses fixed or movable cameras, is nothing new for law enforcement officials. CCTV systems have collected enormous amounts of evidence that help solve thousands of crimes each year.<sup>2</sup> Several important advances in this technology are currently under way in the parking industry, promising improvements in crime investigations, traffic management, and detection of abandoned vehicles and other objects.

Video analytics enable a CCTV system to intelligently determine the subject matter being viewed, rendering it directly applicable to law enforcement operations. This could include vehicle congestion in an intersection, parked vehicles in a no-parking zone, movement or activity in a secure area, and any other situation in which atypical images are captured by the system. This technology also has the ability to track motion in a field of view using parameters such as object size and sensitivity.

### Improving Traffic Management

As parking revenue control systems become more sophisticated, facility information can interface with local law enforcement both in real time and in summarized format. This kind of communication is an asset to traffic management as well as to enforcement. For example, as payment processing is accelerated, vehicles flow more rapidly from parking facilities into the streets, affecting traffic organization and street absorption during peak periods. The technology gives police access to infor-

### Three Ways to Take Advantage of Parking Technologies

- Get to know community parking professionals. Participate in panels or committees during the design or renovation of parking facilities, especially those that are involved in procurement and installation of parking technologies.
- Become a member of the International Parking Institute (IPI). IPI has a membership category for law enforcement professionals. Learn more at <http://www.parking.org>.
- Read articles about advances in parking technology as well as firsthand experiences of law enforcement officials in *The Parking Professional* magazine.

mation about exit trends and traffic flow, enabling them to better manage traffic. This capability is an asset in communities with sports venues, theaters, concert halls, and other facilities in which high-volume traffic surges as events conclude.

The parking technologies outlined in this article—e-payment, lighting improvements, license plate recognition, video analytics, and wireless sensing devices—yield valuable information that can help police officials prevent crime, manage traffic, and present evidence at criminal trials. Clearly, parking operations by nature are a repository of valuable information that can assist law enforcement officials in all facets of their jobs.

Unfortunately, rarely are law enforcement officials involved in making technology-related decisions when a parking facility or on-street parking is being constructed or renovated, nor are they notified when parking facilities update their technologies—technologies that could have significant law enforcement applications. These are missed opportunities for both parking professionals and police officials.

At the local level, law enforcement officials should be involved in technology-related decisions for parking facilities in their respective communities. The local planning and zoning department can serve as the linkage between parking facilities and the police department. When a new facility is planned, or an existing facility is undergoing renovation, law enforcement needs to be represented in an oversight panel or on a committee.

In a recent example, during the renovation and expansion of Logan International Airport in Boston, Massachusetts, police officials were closely involved in decisions made about the technologies used in the parking facility.

Second, beyond specific collaboration at the local level, it is important for law

enforcement and the parking industry to work together to explore specific ways new technologies enable them to share data and information. The International Parking Institute, an association of parking professionals, and its technology committee are willing resources for police officials, providing a nexus in which information about new technologies in the parking industry is available to benefit law enforcement.

Advances in technology provide an opportunity for parking professionals and police officials to work cooperatively to the benefit of the community at large. Resources exist to share data and information that can help law enforcement prevent and fight crime, as well as manage traffic. By joining forces to take advantage of these new technologies today, law enforcement and the parking industry will be in the best position to seize the opportunities presented by the technologies of tomorrow. ♦

### Notes:

<sup>1</sup>Richard T. Wright and Scott H. Decker, *Armed Robbers in Action: Stickups and Street Culture* (Boston: Northeastern University Press, 1997), 137–139.

<sup>2</sup>See Grant Fredericks, “CCTV: A Law Enforcement Tool,” *The Police Chief* 71 (August 2004): 68–74, [http://policechiefmagazine.org/magazine/index.cfm?fuseaction=display\\_arch&article\\_id=359&issue\\_id=82004](http://policechiefmagazine.org/magazine/index.cfm?fuseaction=display_arch&article_id=359&issue_id=82004).

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# VEHICLE RECOGNITION TECHNOLOGY FOR AGE OLD PARKING ENFORCEMENT CHALLENGES

Bill Franklin

Since the horse and buggy age, personal and commercial vehicle parking has preoccupied city planning, operations and enforcement. Politicians and city managers have argued, compromised and hashed out laws and bylaws guiding who can park, for how long, and where, using signage and other means for communicating rules to sometimes unruly citizens.

And, for the most part, the application of bylaws to control timed parking has remained unchanged for at least 70 years, namely parking enforcement officers (PEOs) equipped with a chalk stick to mark tires. Two hours later, typically, our dutiful PEO revisits their beat looking for telltale chalk on unmoved vehicles. Tickets are issued, disputes resolved and the PEO moves on.

But what exactly is the city trying to accomplish through time limited parking?

Typically cities, large and small, are trying to solve these challenges:

- Ensure substantial on-street parking is available
- Small business, a core constituency of city commerce, culture and taxes critically relies on street parking for customer convenience and patronage
- Fees collected from street parking provide supplementary revenue for city coffers (but often discourage customers from patronizing downtown merchants)
- Competition and conflict between stakeholders (for example shop owners versus home owners)
- Reserved parking for high demand enterprises such as hotels
- Traffic flow

Arriving at optimal solutions to these disparate and conflicting challenges is difficult.

For example, small businesses are particularly vulnerable to poor parking turnover, suffer greatly during recessionary times yet have a direct and profound impact on city viability. Vibrant main streets always have eclectic shops, excellent lighting, adequate security and readily available and abundant parking. Vibrant districts are easy to see. The streets and sidewalks are full of people! Typically, these businesses would prefer to see:

- No parking fees
- Regular vehicle turnover
- Soft treatment on first offenders but harsher treatment on scofflaws
- Spill over onto side streets (typically residential)
- Invisible enforcement (so as not to scare off other customers)



autoChalk mounted on Fredericksburg's  
Toyota Highlander Hybrid

Contrast these goals with many cities that do wish to see revenue from the streets or homeowners that do not want any commercial parking on their laneways. The city has to pick what is important and apply consistent rules and enforcement to achieve their goals.

### Vehicle Recognition Technology in Fredericksburg

Take for example Fredericksburg, Virginia. An historic town, home to George Washington, locale to pivotal civil war battles, Fredericksburg is a delightful old city, very popular with tourists, and has eclectic shops and restaurants. But here, as elsewhere, parking is a problem. Parkers not moving, or cheating, limited resources for enforcement, only the downtown being patrolled – all of the classic challenges, but with a twist.

Fredericksburg downtown relies heavily on tourism and the (then) current method of enforcement (penalize all violators, chalk stick and paper tickets) alienated tourists to such an extent that they would angrily declare their intention to never come back in written submissions to the chief of police and the mayor! Clearly this was the tip of an iceberg since countless other visitors wouldn't even bother to write.

Fredericksburg decided on a different tack. They reviewed and set their priorities to accommodate commerce and visitors. These goals were:

- No on-street parking fees
- Regular turnover
- Soft treatment on first offenders but harsher treatment on local scofflaws
- Push all day parkers into new city run garages
- Employ technology to improve productivity of PEO staff

After reviewing various technologies, Fredericksburg approached Tannery Creek Systems to pilot and purchase autoChalk. This product uses digital cameras and lasers to perform vehicle recognition (shape, size and color) and combined with accurate GPS, automatically detects and notifies the PEO of unmoved vehicles. Pictorial evidence is presented to the PEO for violation assessment. AutoChalk is also capable of performing License Plate Recognition (LPR) for Scofflaw searches. Despite its sophisticated technology, autoChalk is very reliable in every day operation and in all temperatures and weather.

#### Fredericksburg also requested:

- escalating ticket fines starting from a warning, then increasing fine amounts
- mail out tickets with photographs and return payment form
- ability to discern where the car owner lives to potentially avoid mailing tickets to tourists and in-state visitors
- interface to the treasury computer system

Fredericksburg has realized tremendous benefits with the application of autoChalk and revamping their parking enforcement focus.

1. Since tourists typically receive cautions, the rate of complaints to the police chief and mayor has dropped to virtually zero. Benefits include increased tourism, shoppers and more favorable visiting experiences.
2. Mailed tickets with initial warnings have been favorably

received, and parkers overwhelmingly follow bylaws. Mailed tickets typically include a map of where to park and the reason for the ticket.

3. Productivity has increased about three-fold. For example, a PEO using the old manual methods takes about five hours to patrol the entire city. An autoChalk equipped PEO takes 40 minutes. PEO's now have more time for enforcing other high priority activities (e.g. handicapped).
4. Parking space availability has improved by about 20%.
5. Overall revenue from tickets is up even though the initial ticket is a warning.
6. Cost of the system is half that of handheld ticket writers and additional staff.
7. Cheating is markedly decreased.
8. Vehicle photos facilitate quicker and more accurate appeal resolution.
9. Enforcement is possible in all weather.

Fredericksburg's implementation of the autoChalk system garnered the city an "Achievement Award for 2008" from the Virginia Municipal League. Chosen from dozens of entries, the award recognized the merits of both the autoChalk system and the process with which it was applied by the city.



Figure 2: User Interface exclusively uses touch screen interaction. Enlargement and inspection of the photos is quick and easy.

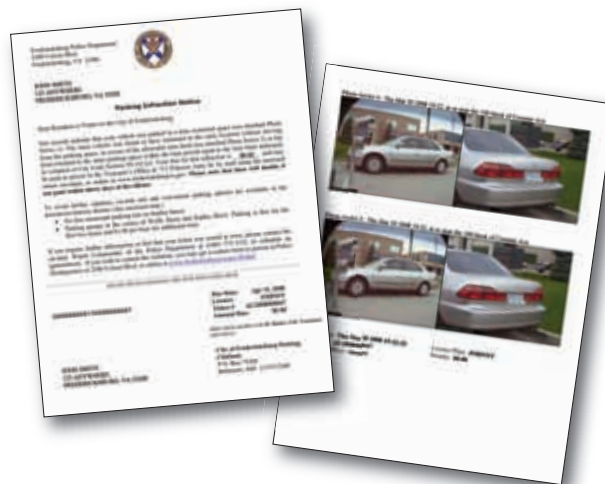


Figure 3: Example of a mail out ticket

# DEPLOYING TOUGH EASY-TO-USE VEHICLE RECOGNITION SYSTEMS CAN MAKE YOUR CITY MORE VIBRANT, ATTRACTIVE TO VISIT, AND GREENER.

## Lessons Learned

Deployment of autoChalk, although reasonably smooth has surfaced important lessons:

1. Escalating tickets can be a challenge. Although it's tempting to have lots of features, it's better to pick a simple model. Fredericksburg's sophisticated escalating ticket system works well, but it consumed considerable management and implementation effort due to disparate systems (new autoChalk, older financial computer system), confusion over escalation rules and applicable fees when voiding tickets. However, escalating fees increased ticket revenue and recurring abuse (scofflaw) dwindled.
2. Interfacing to the Department of Motor Vehicles in real time proved difficult, requiring alternate and slower methods for locating car owners.
3. Surprisingly, overall ticket revenue is up even though the first issued ticket is a warning. Extra revenue is due in part to productivity gains, escalating tickets, decreased parker cheating and extra time available for other enforcement activities.
4. Productivity gains are significant. Since chalking activities take a smaller proportion of the day, the PEO has more time to perform other activities such as handicap, permits and commuter lots enhancing enforcement and contributing considerable ticket revenue.

## Future Uses of Vehicle Recognition

Vehicle recognition technology has potential for shaping and solving other parking challenges. For example, autoChalk has the ability to accurately measure vehicle size to typically one inch (3 cm). Cities can use this functionality to increase street parking at little or no cost and to fulfill green initiatives. In Calgary (population of one million), vehicle owners receive a 25% discount off parking rates downtown when they use small vehicles (under a certain length). Typically up to 10% more small vehicles can be parked when compared to the average.



Figure 4: autoChalk Enforcement in action in Calgary (photo courtesy Calgary Parking Authority)

A second benefit of vehicle recognition technology is quick and accurate parking studies. Often the studies can be turned around in one week starting from gathering of data to the final report. For example a city using vehicle recognition technology surveyed a popular eating and entertainment district suspecting that two hour limits were being widely ignored. In fact, the survey (completed within two weeks) showed that only a small percentage of parkers were staying past two hours and virtually none past three hours. This factual evidence leads to better policy decisions.

A third benefit is more nuanced parking management. It is self evident that whacking people with tickets increases annoyance and diminishes visitor shopping experience. With mail out tickets, tourists and out of town visitors are gently reminded to park appropriately while hard core abusers get legitimately fined.

Cell phone parking is a fourth benefit. Cell phone parking replaces pay and display machines and meters. Typical improvements in overall parking management productivity are significant with enforcement productivity in particular increasing by about four times.

## Summary

Age old methods of chalk and walking still do the job. But deploying vehicle recognition technology can radically improve PEO productivity, improve parking utilization, decrease cheating, and provide all weather operation. Parker acceptance can be greatly improved by using warnings and other material with mail out tickets.

Deploying tough easy-to-use vehicle recognition systems can make your city more vibrant, attractive to visit, and greener. As Fredericksburg has found, even historic cities take kindly to judicious application of appropriate technology. ■

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# Safety, Security, Parking, and Automated License Plate Recognition

Brian Shockley

Automated License Plate Recognition (ALPR) is likely the most talked about technology today among public safety and parking professionals. This technology is growing in acceptance around the world, due to improved performance characteristics and recognition of the benefits provided.

In the simplest of terms, ALPR involves the use of specialized cameras and software that recognize a license plate, capture an image of the license plate, and interpret the characters of the license plate into data that may then be used for one or more purposes.

## Enhancing Safety and Security

The public safety market is the market that receives the most attention in the media, as ALPR is revolutionizing law enforcement and improving public safety and security. Over 50 percent of all crime is related to a vehicle, and the ability to automate the process of identifying vehicles of interest has immense inherent value. Take, for example the recent success seen at Cincinnati Police Department.

A recent armed robbery of a gas station in Cheviot, a suburb of Cincinnati, was recently

solved through the use of the Back Office System Software (BOSS) component of their ALPR network. After seeing a report on the incident, Captain Jeff Butler contacted



Cheviot Police Department to determine if there was a license plate associated with the robbery. Cheviot found that witnesses had reported the license plate number of a vehicle seen speeding away from the scene of the crime, but that the plate belonged to a man in prison which gave them little information to work with in their investigation. Captain Butler then turned to Heather Whitton in the Information Technology Section of Cincinnati Police Department to investigate what information they could provide on the vehicle. Heather queried the license plate in their BOSS system which collects all of the data collected by the City's seven mobile systems. Within a matter of minutes, she reported, "It's a light blue Honda with some damage to the front end of the vehicle, and I have pictures of it on the morning of the crime." She was then able to map all sightings of the vehicle, finding that the vehicle was frequently seen on a certain street parked in front of a stone wall.



"With the intelligence provided by the Federal Signal BOSS System, we were able to locate this vehicle, set up surveillance, and wait for the suspect to arrive," says Captain Jeff Butler. "The suspect arrived at which point an arrest was made. The photos were shown to the suspect, and he knew that we had him. Without the system, this individual would probably still be on the streets presenting a danger to our officers and to the public. This is one of the many cases that the system has helped us solve, including several homicides. Because of the great success of the system, we are planning to invest in

building out the system to include additional mobile systems and fixed cameras."

### Improving Parking Operations

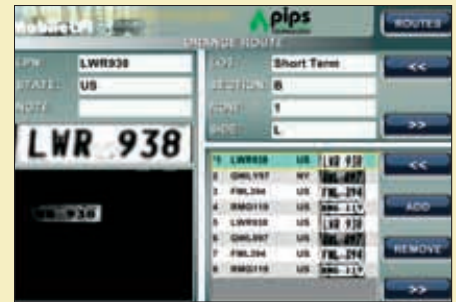
ALPR has several major application subsets in the world of parking including parking enforcement, parking operations, vehicle inventories, and access control and security. These applications are becoming increasingly popular because of the rapid return on investment typically achieved. ALPR is being used in these applications within universities, airports, medical centers, shopping malls, military bases, corporate campuses, and many other facilities.

Just south of Cincinnati, the University of Kentucky's Parking and Transportation Services (PTS) Department has recently installed an automated license plate recognition (ALPR) system on one of its parking control vehicles to locate vehicles that have outstanding parking violations. The system will benefit permit holders by efficiently locating vehicles with unpaid citations in campus controlled parking areas, effectively making more spaces available to those with valid parking permits and in good standing with the University.

The system checks every license plate against a data file of scofflaw vehicles, or vehicles with outstanding parking violations. When a match is found, the officer is immediately notified with an audible and visual alert on a laptop computer in the front of the vehicle. The data file, generated from PowerPark Flex (or the PTS' parking database), is updated each morning by the Federal Signal Back Office System Software (BOSS) which automatically logs in to an FTP site, downloads and formats the data for the ALPR system, and makes it available to the PTS vehicle.

The University had previously used the technology for over a year at a fixed location with great success monitoring vehicles entering its medical center garage, so the decision to install an ALPR system on a vehicle was an easy one given its track record of success. Just after configuration, while training the users, the PTS vehicle equipped with ALPR located a vehicle with six outstanding violations. Within the first 40 minutes, the system had read over 2,500 license plates, and located five vehicles with a total of 15 outstanding violations!

Longer term, the University may use the system to look for stolen vehicles, look for overstay vehicles in time-enforced parking



locations, collection of vehicle inventories, and more. PTS Director Don Thornton commented, "This technology is amazing. It adds value to parking permits by allowing us to enforce parking regulations effectively and efficiently. The PIPS system is a sound investment and a good business decision."

### A Wise Investment with a Quick Return

The applications for ALPR are limited only by the imagination. The technology is widely acknowledged by customers for its almost immediate return – whether that be a measureable improvement in the efficiency of parking operations or increased revenue due to better enforcement of scofflaws, or a softer benefit such as providing for more intelligent investigative tools to take criminals off the street and improve the safety and security of the surrounding community. ALPR is a valuable technology that is here to stay. ■

*Brian Shockley* is Vice President of Marketing for Federal Signal's Public Safety Systems Division. His career of business development, marketing, and product management began within new ventures for established companies such as John Deere and Valvoline. Prior to Federal Signal's acquisition of the company, Brian led the marketing efforts for PIPS Technology, the world leader of automated license plate recognition. Brian's educational background includes a BS degree from Carson Newman College, an MBA from the University of Tennessee, and a Strategic Marketing Management Course at Harvard Business School. Brian may be reached at (865) 392-5546 or [bshockley@federalsignal.com](mailto:bshockley@federalsignal.com).

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## 2 Contact Information

Name \_\_\_\_\_

Title \_\_\_\_\_

Organization \_\_\_\_\_

Street Address \_\_\_\_\_ P.O. Box \_\_\_\_\_

City/State/Zip \_\_\_\_\_ Country/Postal Code \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

E-mail \_\_\_\_\_ E-mail 2 (optional) \_\_\_\_\_

Website URL \_\_\_\_\_

## 3 Payment Information

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PLEASE SELECT WHICH CARD:  MasterCard  Visa

American Express  Discover

Account Number \_\_\_\_\_ Security Code \_\_\_\_\_

Account Name \_\_\_\_\_ Expiration Date \_\_\_\_\_

Billing Address (if different from address above) \_\_\_\_\_

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