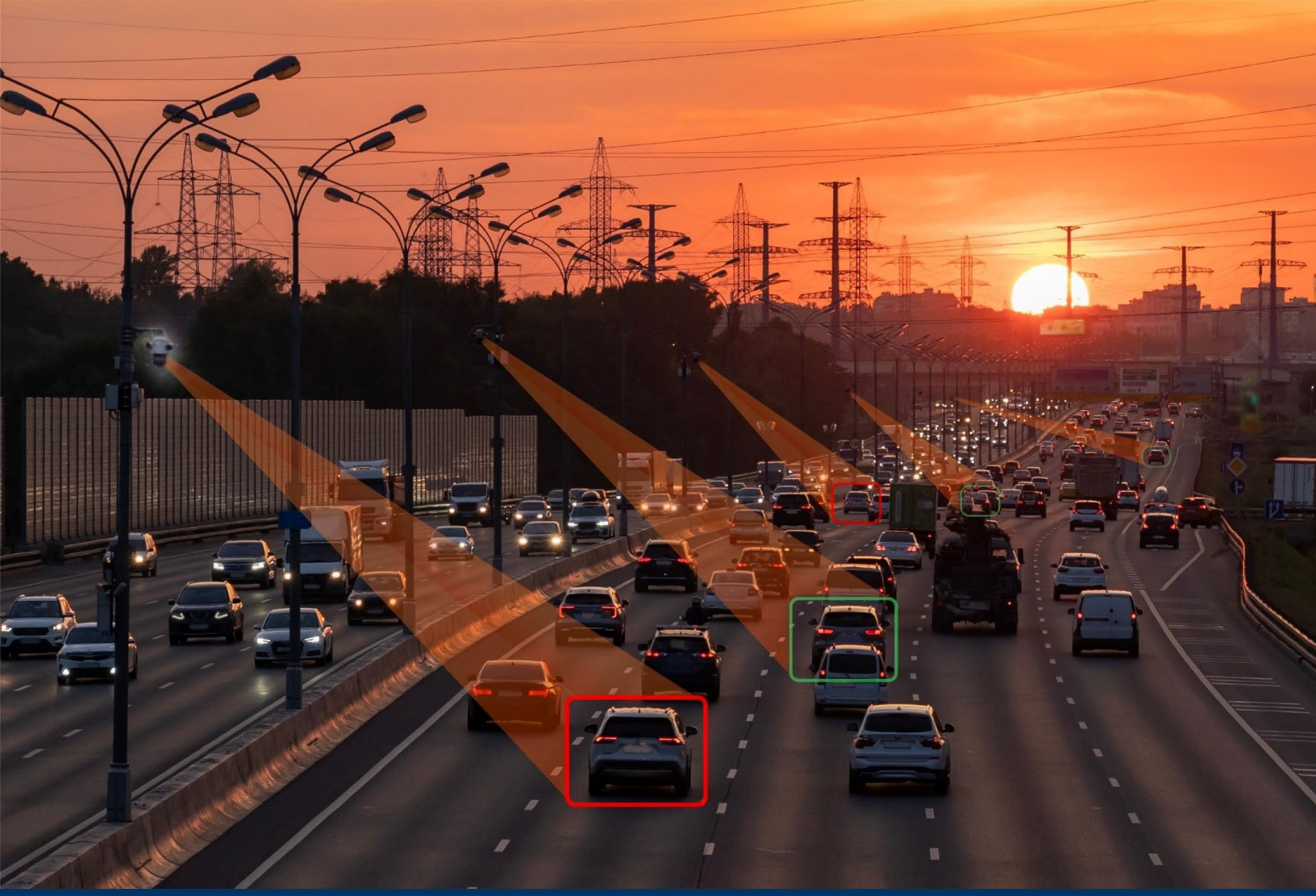

Automated License Plate Readers

Market Survey Report

June 2025

Science and Technology

NUSTL®
NATIONAL URBAN SECURITY TECHNOLOGY LABORATORY

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The “Automated License Plate Readers Market Survey Report” was prepared by the National Urban Security Technology Laboratory—in conjunction with DAGER Technology —for the U.S. Department of Homeland Security, Science and Technology Directorate pursuant to 70RSAT24KPM000007.

FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of federal, state, local, tribal, and territorial responders to address the homeland security mission. The laboratory assists responders with the use of technology to prevent, protect against, mitigate, respond to, and recover from homeland security threats and incidents. NUSTL provides expertise on a wide range of subject areas, including chemical, biological, radiological, nuclear, and explosive detection, personal protective equipment, and tools for emergency response and recovery.

NUSTL manages the System Assessment and Validation for Emergency Responders (SAVER®) program, which provides information on commercially available equipment to assist response organizations in equipment selection and procurement. SAVER knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: "What equipment is available?" and "How does it perform?" The SAVER program works with responders to conduct objective, practitioner-relevant, operationally-oriented assessments and validations of commercially available emergency response equipment. Having the right tools provides a safer work environment for responders and a safer community for those they serve.

NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, and coordinating with other organizations to leverage appropriate subject matter expertise. In conjunction with DAGER Technology, NUSTL conducted a market survey of commercially available Automated License Plate Readers (ALPR). This equipment falls under the AEL reference number 03OE-01-ALPR, "System, Automated License Plate Recognition."

SAVER reports are available at www.dhs.gov/science-and-technology/SAVER.

Visit the NUSTL website at www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory or contact the lab at NUSTL@hq.dhs.gov.

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders ®

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EXECUTIVE SUMMARY

Automated license plate readers (ALPRs) have been part of law enforcement's toolkit for well over two decades. ALPR systems use cameras and software to automatically capture, analyze, and store vehicle license plate information. ALPR systems compare license plate numbers against databases to generate alerts and create records of vehicle activity. ALPR systems have proven to be a valuable investigative tool for law enforcement. Advances in machine learning, computer vision, and artificial intelligence (AI) have made ALPR systems more affordable and more effective.

Between January 2024 and August 2024, the System Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey of commercially available ALPR systems for use by law enforcement. This market survey report is based on information gathered from manufacturer and vendor websites, internet research, industry publications, and a government-issued request for information that was posted on the System of Award Management website.

The survey identified 16 commercial off-the-shelf systems, all of which offer either a completely integrated ALPR system or an ALPR software-based system that can be integrated with new or existing ALPR hardware. All are compliant with both Federal Bureau of Investigation (FBI) Criminal Justice Information Services Security Policy and National Defense Authorization Act Section 889. The prices for these products vary significantly depending on the size and scope of the ALPR project, the type of installation (e.g., cloud-based or on premises), and the purchase type (subscription, licensing, purchase, etc.). Performance of the products and information included in this report has not been independently verified by the SAVER program.

The purpose of this market survey is to provide law enforcement officers with information that will guide their agencies in making operational and procurement decisions. When evaluating ALPR systems, law enforcement agencies should consider the overall capabilities, technical specifications, limitations of, and policies related to the use of ALPR in relation to their agency's operational needs. Furthermore, agencies should also consider the integration of ALPR equipment into existing information technology infrastructure, data management, concept of operations, licensing, and required maintenance. By thoroughly examining these factors, emergency response agencies can make well-informed decisions that align with their specific requirements and operational goals.

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1.0 INTRODUCTION

Automated license plate readers (ALPRs) use cameras and optical character recognition (OCR) technology to automatically capture, analyze, and store vehicle license plate information. ALPR systems can rapidly scan and process license plate information, compare license plate numbers against databases to generate alerts, and create records of vehicle activity. ALPR systems consist of both software and hardware such as cameras and frame grabbers. ALPR cameras can be mounted in fixed locations, on portable platforms (such as mobile trailers and Wi-Fi–connected solar systems), in law enforcement vehicles, or integrated into mobile devices. ALPR systems can be used as an investigative tool to recover stolen vehicles, solve crimes, generate investigative leads, or gather crime scene data. They are also used to protect infrastructure, improve the security of special events and large mass gatherings, improve traffic management, conduct electronic toll collection, and aid in parking management.

ALPRs have been part of law enforcement's toolkit for over two decades. In April 2013, the System Assessment and Validation for Emergency Responders (SAVER) program published a License Plate Recognition Database Software Market Survey Report [1]. ALPR technology, however, has evolved rapidly in the past several years, radically changing who is able to access ALPRs and what they are able to do with them. With advances in machine learning, computer vision, and artificial intelligence (AI), ALPR systems now can read much more than license plates. ALPR software can detect dents on cars, search for specific bumper stickers, process specialty tags, and recognize rideshare logos [2].

Between January 2024 and August 2024, the SAVER program conducted a new market survey of commercially available ALPR systems for use by law enforcement. This market survey report is based on information gathered from manufacturer and vendor websites, internet research, industry publications, and a government-issued request for information that was posted on the System of Award Management website. The U.S. Department of Homeland Security (DHS) Science and Technology Directorate's (S&T) Technology Scouting Group also contributed to the market research used to develop this report.

A total of 16 ALPR systems are included in this report. Each system meets the following criteria:

- Is available as a commercial off-the-shelf (COTS) product
- Is an ALPR software system or a completely integrated ALPR system including hardware and software
- Is compatible with fixed, portable, vehicle-mounted, and/or cellphone-based cameras
- Can perform character recognition on license plate images for all 50 U.S. states, compare extracted data to "hot lists," and trigger alerts for matches[1]
- Can receive raw images or processed data from license plate readers (LPRs) or cameras owned and operated by external entities
- Complies with Federal Bureau of Investigation (FBI) Criminal Justice Information Services (CJIS) Security Policy [3]
- Complies with National Defense Authorization Act Section 889

[1] Hot lists are law enforcement databases of known license plates and vehicles of interest that are typically associated with stolen vehicles, vehicles involved in criminal activity, or vehicles associated with missing or wanted persons.

2.0 TECHNOLOGY OVERVIEW

ALPR cameras are deployed by law enforcement agencies at fixed strategic locations, on police vehicles, on portable units like speed warning trailers, and via mobile devices (smartphones, body cameras, etc.) to capture license plate information. Fixed ALPR cameras can be mounted at community entry and egress points, key traffic management areas, and critical infrastructure to improve overall community safety and law enforcement operations. Vehicle-mounted ALPR cameras may be mounted on police vehicles, parking enforcement vehicles, or commercial tow-trucks. Portable ALPR cameras are especially useful in the support of special law enforcement operations like special events, large public gatherings, retail theft suppression, and other events.

ALPR cameras may also be app-based, using the built in camera in standard Android and iOS smartphones to capture plate images. App-based ALPR is typically used for parking enforcement by municipalities or private entities or by companies that perform automotive repossession work. It may also be used as an additional component of an integrated law-enforcement ALPR network, supplementing a jurisdiction's fixed, portable, and vehicle-mounted ALPR cameras. ALPR systems may also be integrated with non-law enforcement functions within a jurisdiction, such as parking access controls or toll readers.

A complete ALPR system consists of hardware and software to capture images, optimize the images for license plate detection, crop the license plate image, use OCR to capture the license plate information, and process and store the license plate information according to the agency's requirements. ALPR hardware typically consists of cameras and frame grabbers that capture the video images. The remaining processes of plate recognition, analysis, and any relevant alerting are performed by ALPR software; this includes comparing captured data against hot lists, law enforcement databases of known license plates and vehicles of interest that may be stolen, involved in criminal activity, or associated with missing or wanted persons.

Important considerations in selecting an ALPR system include:

- License plate background colors and the states and countries supported
- Vehicle speeds supported
- Number of travel lanes covered by a single camera
- Effective horizontal and vertical angle captured by the camera
- Minimum plate size captured in number of pixels
- Number of frames needed for reliable plate recognition

2.1 Current Technologies: Hardware

ALPR systems use a variety of hardware including dedicated ALPR cameras, illuminators, frame grabbers, and edge hardware. Dedicated ALPR cameras typically capture infrared images of the license plate number, a color image of the vehicle, and the vehicle's global positioning system (GPS) coordinates. The ALPR hardware then places a date and time stamp on the image. Frame grabber hardware processes existing video camera feeds to expand the ALPR network by converting analog images to digital signals and capturing still frames from video streams. ALPR systems may also incorporate edge hardware to perform localized analytics prior to sending the processed data to ALPR software.

2.1.1 ALPR Cameras

Depending upon the features of an ALPR system, each installation will have an infrared camera designed to take photos of license plates in all conditions, and often a second color camera designed to take a "contextual" photograph or video of the entire vehicle.

Camera installation is key to successful plate reading, with fixed systems typically using a triggered setup with a fixed focal point, angle, and lighting designed to capture images optimized for the ALPR software. Vehicle-mounted systems, such as those that are mounted on police vehicles, can analyze live-stream video to capture tags but may have limitations imposed by the closing speed with another vehicle or high angles of approach.

2.1.1.1 Camera Effectiveness

Measures of the effectiveness of ALPR cameras include:

- **Capture rate**: Capture rate is the percentage of vehicles that the ALPR system can successfully detect out of all vehicles that pass the ALPR camera. A quality camera should be able to continuously scan a high volume of cars in a short time span. Factors that influence capture rate are the frame rate of the camera expressed in frames per second (FPS), image processing power, and the type of scanning (continuous or triggered). Environmental factors like rain, fog, illumination, glare, and lens cleanliness can also impact the ability of the system to capture license plate images quickly and clearly.
- **Read rate:** The read rate is the percentage of license plates that were read correctly out of the total number of plates presented to the ALPR system. Read rate can be affected by both external and internal factors. External factors include things like weather conditions, lens cleanliness, obstructed or degraded license plates, foreign license plates, the camera mounting location, and the speed and direction of vehicles. Internal factors that affect read rate include camera quality, camera calibration, ALPR software optimization, the ALPR training data, confidence thresholds,[2] post-processing algorithms, and legal requirements like retention time. For example, short retention times may impact the ability of civilian data analysts to manually analyze prior reads for accuracy and for training the system against read errors [4].
- **Accuracy factors:** ALPR cameras used in law enforcement applications are typically non-triggered, meaning the system reads every single frame from live video and applies special analytics.[3] Non-triggered accuracy is affected by many external factors, including the type of tag (standard tags vs. specialty), out-of-state tags, non-reflective plates, and human unreadable plates. ALPR systems may also generate false events, including phantom events like the detection of other objects such as bumper stickers or double reads, which occur when the ALPR system returns more than one read on the same plate.

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[2] A confidence threshold is a percentile score assigned by programmers which assesses quality parameters within each captured plate read. High confidence reads are assumed by the system to be accurate while those reads below the confidence threshold may be flagged for further processing or manual review.

[3] Conversely, a triggered system uses sensors like inductive loops embedded in the roadway to detect vehicles at a precise position. When a vehicle triggers the sensor, the camera system records one or more photographs to be processed by the ALPR software.

2.1.1.2 ALPR Camera Features and Specifications

When selecting cameras for an ALPR system, several features and specifications are important to consider. Some of the common features and specifications are listed below:

- **IR (Infrared) and color capture ability:** Some ALPR cameras offer both IR (typically displayed in black-and-white) and color capture capabilities. Depending upon the camera, the modes may be selected independently or work in tandem:
  - IR mode: Enables night vision and captures plates in low-light conditions. IR capable systems typically use supplemental IR spotlights to assist in illuminating plates.
  - Color mode: Provides additional context (vehicle color, type) for investigations.
  - Auto mode: The camera switches from Color Mode to IR Mode based upon time of day or lighting conditions.
  - Hybrid mode: Two cameras continuously function in tandem, using software to select the best image for plate readability.
- **Shutter type:** ALPR cameras use either rolling shutter or global shutter technology.
  - Rolling shutter captures images by scanning from top to bottom (row by row).
    - May cause distortion in fast-moving scenes due to varying exposure times.
    - Suitable for stationary cameras or slower traffic scenarios.
  - Global shutter captures the entire frame simultaneously.
    - Minimizes motion blur and ensures consistent exposure.
    - Ideal for ALPR applications, especially with fast-moving vehicles.
- **Image resolution:** Image resolution refers to the number of pixels in an image.
  - Higher resolution cameras capture more details.
  - High resolution allows better character segmentation and readability, helping distinguish similar-looking characters (e.g., “8” vs. “B” or “0” vs. “O”, See Figure 2-1).

Figure 2-1 High resolution aids discrimination between similar characters

- **Frame rate:** Frame rate represents how many frames (images) the camera captures per second.
  - Fast-moving vehicles require a high frame rate to minimize motion blur. A higher frame rate improves real-time recognition.
  - The higher the frame rate at which the images are captured, the smoother the video. A smooth video feed ensures consistent plate visibility.
- **Shutter speed:** Shutter speed controls how long the camera's sensor is exposed to light.
  - Fast shutter speeds (e.g., 1/500 or faster) reduce blur caused by vehicle motion.
  - Clear, crisp images enhance plate recognition accuracy.
- **Lens quality:** Lens quality affects image clarity, distortion, and light transmission.
  - High-quality lenses have precise build quality and exhibit excellent sharpness, minimal distortion, and low chromatic aberration, all of which can be quantitatively measured.

  - The build quality of a lens entails both objective and subjective measures like effective weather sealing, robust construction materials, smooth and quick focus adjustments, and a reputable, reliable brand.
  - Good light transmission ensures optimal image brightness, while sharp focus improves plate readability.

- **Field of view (FOV):** FOV is expressed in degrees of angle and determines the area the camera covers.
  - Wide-angle FOV covers more lanes or a larger area but can produce a "fisheye" effect, or distortion of the image at its edges that may affect plate readability.
  - Narrow FOV covers more limited zones, for example, focusing on specific entry/exit points, which may provide a balance of coverage and recognition accuracy.

- **Weather resistance:** Reliable operation in various conditions ensures continuous monitoring.
  - Outdoor ALPR cameras need protection against environmental factors.
  - Weatherproof cameras withstand rain, dust, and extreme temperatures.
  - Weather resistance is sometimes scored using laboratory tests as specified by International Electrotechnical Commission (IEC) standard 60529. (See section 2.7) Products that have been tested this way will bear an ingress protection (IP) rating.

- **Mounting options:** Different mounting options (fixed, portable, mobile) suit various applications.
  - Fixed cameras cover specific areas (toll booths, intersections, etc.).
  - Portable cameras can be placed in areas of acute concern when warranted and moved to other "hot spots" when needed.
  - Mobile units (e.g., vehicle-mounted cameras and cellphone cameras) provide flexibility for law enforcement in daily patrol operations and specialized crime enforcement tasks like tracking auto theft and augmenting fugitive task forces.

- **Connectivity:** Cameras may support ethernet or Wi-Fi connections.
  - Ethernet ensures stable data transfer, while Wi-Fi simplifies physical installation and reduces cabling.
  - Power over Ethernet (PoE) combines power and data over a single cable.
  - Some Wi-Fi cameras are solar powered, making them completely portable without external power requirements.

- **Integration with ALPR software:** Some cameras come with built-in ALPR capabilities which integrate seamlessly with ALPR software.
  - Direct integration streamlines setup and configuration.
  - On-camera processing reduces the data traffic across the ALPR network.

2.1.2 Illuminators

Dedicated ALPR systems often use IR illuminators to enhance their performance, especially in low-light or nighttime conditions. IR illuminators emit light that is invisible to the human eye but can be detected by ALPR cameras, thus preventing drivers from being startled or temporarily blinded by a visible light flash. By providing additional illumination, IR illuminators improve the clarity and contrast

of license plate images, making it easier for ALPR systems to accurately recognize and read license plate characters.

2.1.3 Frame Grabbers

A frame grabber is a circuit board that is mounted in a computer and can connect to non-ALPR-specific video cameras to expand ALPR system coverage. A frame grabber captures high-quality digital images from analog or digital video camera feeds. These still images are then processed by the ALPR software's OCR capability to extract a vehicle license plate's character and issuing authority. Some frame grabbers may have onboard processing systems that also optimize the images for OCR. Some frame grabbers can also be used to extract still frames from previously recorded video files.

2.1.4 Edge Hardware

Edge hardware is essential in robust ALPR systems. These devices are essentially miniature computers running software programs optimized to perform specific processing tasks. Positioned close to data sources like cameras and sensors, edge hardware performs real-time video processing tasks like white balance, image sharpening, or even the full processing of license plate character recognition. This work by edge hardware minimizes the amount of data that must be transmitted across ALPR networks and reduces the workload on centralized cloud servers or station-based desktop machines. By analyzing video directly at the source, edge hardware reduces network latency and enhances overall system performance.

2.2 Current Technologies: ALPR Software

ALPR software ranges in complexity from simple smartphone apps that read plates and compare them against user-generated hot lists to sophisticated systems that use machine learning and artificial intelligence to conduct complex analysis. The most sophisticated software can process images, read the plate number, determine the make, model, color and year of a vehicle, compare plates against local and national hot lists, make predictions on probable routes of travel, send localized alerts to law enforcement units in the area, automatically generate vehicle activity reports, and analyze system results to improve future system accuracy.

2.2.1 LPR Image Processing

Once a frame grabber extracts a still image from the ALPR video stream, the image must be processed before sending it to the software's OCR module. This increases the likelihood of an accurate plate recognition. The steps may include several standard image enhancement techniques common to photography, including but not limited to:

- Noise reduction: "Noise" refers to visual errors inherent to all digital imaging techniques that are caused by camera sensor flaws, heat, static, irregular lighting conditions, or chromatic aberrations. Noise often looks like the grain in traditional film photography. In ALPR systems the software adjusts the input image to remove noise, thereby enhancing the quality of the license plate region of the image.
- Contrast enhancement: Contrast is the difference between the brightest and darkest colors within a photograph. Adjusting the contrast in extracted images helps improve license plate character visibility.

- **Thresholding:** Thresholding uses a pre-defined grayscale level to determine if a pixel in a photo should be classified as pure black or pure white. By converting all pixels to black or white, the computer can better classify an area as being either the object of interest (the license plate or its characters) or the background area of a photo.
- **Metadata:** Metadata refers to information that the software embeds in or appends to the extracted image, including the date, time, location, and direction of travel of the vehicle. Other digital data such as camera settings, post-processing adjustments, and the image filename may also be included. Metadata may be added to the image by the camera, the frame grabber, edge hardware, and/or the ALPR software.

2.2.2 License Plate Character Recognition

ALPR software uses one or more programs to extract the alphanumeric data within a license plate. The software must flatten or de-skew the image, detect license plates within an image, implement character segmentation techniques to isolate individual characters on the license plate, use object character recognition to recognize the segmented characters, and, finally, integrate the components to recognize the complete license plate number [5].

A second component of license plate recognition is the recognition of the plate's issuing authority. Each state within the United States uses unique designs for their license plates, which may include the name or abbreviation of the state, unique fonts, unique number or letter patterns, unique symbols, or distinct colors. Most states also have numerous designs, including vanity plates, available to their residents. To increase the likelihood that plates are accurately recognized, ALPR software often incorporates machine learning pattern recognition or artificial intelligence algorithms. These algorithms are "trained" against databases of known license plates. Recognition efficiency can be increased by manually rejecting or validating individual read results, even after the system is deployed in the field.

2.2.3 Other Features

Some ALPR systems are capable of augmenting character recognition with vehicle recognition features including identifying vehicle make, model, color, and direction of travel. Using AI, the software analyzes either the full-frame image taken for plate recognition, or a separate photo taken specifically of the entire vehicle, comparing the shape and distinct features of the vehicle against a database of known vehicles. Some systems capture vehicle color information. The extracted make and model (and color, if applicable) of the vehicle in the photograph can be compared against hot lists or vehicle registration records to confirm the OCR data taken from the plate, assist in identifying vehicles with partial, obstructed, or missing plates, or assist in locating suspect vehicles where no plate information was obtained by witnesses. Some systems can also compute dwell time, the amount of time a vehicle remains within a defined area. (Dwell time calculations assume a vehicle has no routes of egress without passing an ALPR camera.) Others have been programmed to read and track the U.S. Department of Transportation required placarding on the side of tractor trailers, which is useful for commercial motor vehicle enforcement.

Some ALPR systems can also read boat registration numbers, which most jurisdictions require to be displayed on the sides of hulls. These systems can be used via apps on mobile phones or mounted at fixed locations like harbor and marina entrances to monitor boat traffic in much the same way that automotive tags are analyzed.

2.2.4 Desktop, Tablet, and Mobile Applications

The user interface software for ALPR systems is typically available in a variety of forms, each one serving specific purposes. Users must decide which form factor best suits their needs in terms of mobility, scalability, offline access, and system integration.

- **Web-based applications** are accessible via internet browsers and work across most operating systems. They are scalable to multiple users but require an active internet connection.
- **Desktop applications** are proprietary programs installed on computers. Desktop applications are specific to an operating system (e.g., Windows, Mac, Linux). They may offer better performance than web-based applications and can work both online and offline.

Figure 2-2 Web-based ALPR application

Image Credit: Leonardo

- **Mobile apps** are designed for smartphones and tablets. They provide optimized user experiences and platform-specific features. Offline features will differ between manufacturers.
- **Mobile data terminals (MDTs)** are installed in many law enforcement vehicles. These are specialized devices (usually ruggedized laptop computers) used for dispatching calls, checking suspect and vehicle records, and for communicating among dispatch centers and officers in the field. MDTs can be equipped with ALPR software for real-time plate recognition during patrols. Some ALPR software can integrate with existing dash cameras to leverage them as ALPRs; however, dedicated ALPR cameras integrated with MDTs yield the highest quality results.

2.2.5 Hot Lists and Alerts

Hot lists are law enforcement databases of known license plates and vehicles of interest that are typically associated with stolen vehicles, vehicles involved in criminal activity, or vehicles associated with missing or wanted persons. ALPR systems allow for the manual entry of hot lists by the agency and the automatic import of hot list records from the National Crime Information Center (NCIC), Amber and Silver Alerts, and/or state law enforcement databases, if applicable. ALPR systems generate alerts when vehicle plates match the hot list records. ALPR hot lists can trigger alerts on computers, mobile devices, on apps, and on patrol car MDTs.

To maintain the accuracy and effectiveness of the ALPR system, vehicle license plate information must be verified by separate law enforcement information sources to confirm the vehicle's alert status and provide justification for law enforcement contact. Law enforcement users of ALPR data must, to the fullest extent possible, visually confirm that the plate characters generated by the ALPR readers accurately correspond with the digital image of the license plate in question [6].

2.2.6 Search Types

In addition to automated hot list matching, all ALPR systems can perform searches against an agency's databases of stored data from previous ALPR-captured images. Depending upon system capabilities, local laws, and agency policies, this stored data can range from just the text of license

plate data with its location metadata to images of both the plate and the vehicle with a full AI analysis.

- **Time and location:** Because ALPR photos have date, time, and location data associated with each capture, software searches can be performed against those variables. By performing a geofenced search of an area covered by ALPR cameras, within a specified period surrounding the time a crime was committed, investigators may be able to generate leads of potential suspects.
- **Partial tag:** Police regularly investigate crimes where a witness or camera captures only a portion of a license plate. Armed with this information, officers can perform "offline" searches of stored ALPR data using various logical operators. When combined with witness information on the make or model of a car, police may be able to narrow their search for suspects. For example, a witness may report that the suspect vehicle was a brand-new Ford Ranger truck with a California plate starting with ABC, but they did not see the last four characters. By searching the ALPR database for every 2020–2024 Ford Ranger with California plates that starts with ABC, investigators may generate a lead in the investigation.
- **Wildcards:** Wildcards are characters that are substituted in an alphanumeric search string in place of unknown or obscured information. In ALPR systems, wildcard characters like "%," "?," and "*" allow authorities to search for partial license plate information, track suspect vehicles, and identify patterns related to criminal activity. For example, if a witness to a crime recalled the first five characters out of six on a suspect's license plate as ABCDE, the system operator could search the ALPR records for "ABCDE?" using "?" as the wildcard. This would search the system for all captured plates that start with ABCDE and end with any single valid alphanumeric character. In this example, the search could return up to 36 license plates (ending in A–Z (26) or 0–9 (10)). Further investigation into vehicle make, model, and color could narrow the field and lead to the identification of a suspect vehicle seen in the proximity to a crime scene.

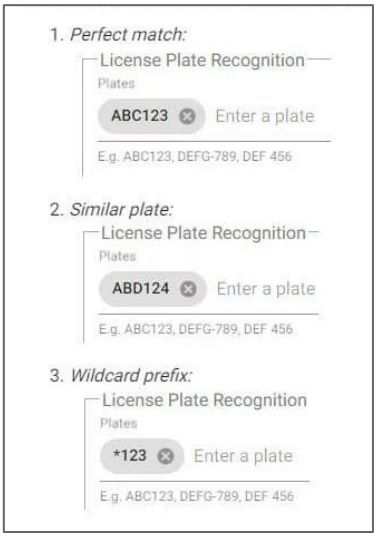

Figure 2-3 Plate Recognizer search options

Image Credit: Plate Recognizer

- **Year, make, model:** For systems using vehicle recognition features, the extracted vehicle data become searchable fields. Note that the data comes from internal system analysis and is not generally associated with vehicle registration records.
- **Free-form data:** As AI features are being further integrated with ALPR, systems are becoming more capable of searching images for free-form information. In the same manner that one can now request a smartphone's photo app to search for all images containing "dogs," ALPR systems are gaining the capability to search all captured photos for, as an example, a "red truck with black toolbox mounted on the bed" or a "blue, 4-door hatchback with yellow smiley face bumper sticker."

2.2.7 Accuracy

Figure 2-4 Plate clarity at differing pixel counts

Image Credit: OpenALPR

While any Internet Protocol (IP) camera can be used in an ALPR, users will achieve the best results from considering the pixel width of the license plate necessary to achieve effective recognition. Some companies recommend that the plate be at least 100 pixels wide within an image for reliable recognition. Even in high-resolution images, if the plate occupies only a small portion of the frame, accuracy is reduced. Optimizing camera setup and adhering to well-defined plate image dimensions contribute significantly to reliable ALPR results. Paying attention to pixel width enhances performance and accurate recognition.

Users of ALPR must understand that ALPR data may not be accurate and should be confirmed by ALPR operators before taking enforcement action based on ALPR system-generated results. For example, as ALPR technology translates optical characters to digital information, a small error rate occurs in the translation of alphanumeric characters that are similar in shape (e.g., the numeral zero and the letter "O," the numeral one, and the letter "I"). Also, ALPR system accuracy can be reduced by license plate covers, increased tag reflectivity, dirt on the tag, and by certain license plate frames that obscure relevant identifying data on the plate. Some drivers may intentionally modify or obscure their license plates to defeat ALPR technology.

2.2.8 Analysis

Because of the possibility of errors in the automatic analysis of LPR data, manual analysis (performed by human operators) is required in law enforcement applications. Manual intervention is needed for:

- **Quality control:** Operators should routinely review ALPR results, ensuring accuracy and identifying any false positives or negatives. This step can be used to "train" systems which have AI or machine learning functionality, assisting in increasing its accuracy for future reads.
- **Verification:** After receiving an automated "hit" on a license plate, users must manually verify that the license plate OCR characters reported by the system visually match the photo of the plate. The operator must then verify that the plate matches against the hot list. Users may also decide to separately verify that the vehicle details match a jurisdiction's registration data as indicated by the license plate.
- **Exception handling:** Operators may address cases where automatic analysis fails (obscured plates, non-standard formats, etc.).
- **Data entry:** If necessary, operators may manually enter additional information related to the license plate (vehicle make, model, color, case ID number, etc.).
- **Investigations:** ALPR data provides evidence only of the presence of a license plate at a location at a particular place and time. Further analysis is required to establish that the plate is likely mounted on the vehicle to which it is registered. Also, license plate data does not establish the identity of the driver or occupants of the vehicle at the time it was logged by the ALPR. However, information from ALPR may help users identify a suspect or give investigators insight into potential associates or accomplices of suspects.

2.2.9 Databases, Storage, Evidence

Because images require large amounts of storage and systems may process thousands of images per day, ALPR systems typically do not store all photos taken. Instead, they focus on capturing and processing license plate and vehicle data. Images are analyzed in real-time to extract the license plate number and pertinent vehicle data. If a match is found between a captured license plate and a hot list, the image(s) will be saved, and relevant data (such as the image, timestamp, and location) may be stored for investigative purposes. Images of license plates that do not match any hot list entries are typically discarded immediately or after a short retention period to minimize data storage requirements. The extracted plate data is typically retained for longer periods and is easy to store in small, text-based database files. The retention period varies by jurisdiction due to privacy laws and regulations.

Various storage schemes exist for ALPR data. Agencies may use local storage on their computers or servers, or they may choose to process data locally and use cloud-based storage providers. ALPR software can be integrated into existing agency record management systems through application programming interfaces (APIs). Agencies using locally installed software are responsible for network security and for keeping their software up to date to prevent security issues. To further ensure the integrity of ALPR data, ALPR systems typically encrypt all data while both in-transit across networks and while being stored on servers.

Software-as-a-service (SaaS) applications run on the software provider's servers, delivering functionality via the internet to any device having connectivity and the required browser or interface. Access to the application is obtained via a subscription rather than outright purchase, with all updates and configuration requirements handled by the service provider. Agencies should consider the security aspects of SaaS for ALPR, particularly the availability and the protection of sensitive information stored remotely. Internet connectivity is required to use SaaS applications unless specific failover measures such as a "hybrid cloud" are available. Agencies should also consider contractual obligations, such as the term of the contract and termination fees, as well as ownership of data and liability for data loss. Use of SaaS for mission critical applications should be thoroughly vetted before implementation [7].

Since ALPR images may become evidence in court, agencies should examine the verification and security features available in a law enforcement ALPR system. Typical security features used to verify evidentiary photos include embedded timestamp data, geolocation data, and what is known as "hash data." To create hash data, an algorithm applies a mathematical formula to the binary data in a computer file and generates a fixed-length string of characters (the hash) that it associates with the photo. Even a small change in the input data would result in a completely different hash, a property that makes hashes useful for verifying data integrity and ensuring that the original photo taken is the same as the photo presented as evidence.

2.2.10 Sharing and Third-Party Integration

To leverage the advantages of ALPR data in law enforcement, many jurisdictions around the country have banded together with other agencies to share ALPR data. There are differences in data privacy laws among jurisdictions, however, so this sharing tends to be regional or state-based instead of nationwide.

One example of regional sharing is California's Automated Regional Justice Information System (ARJIS). ARJIS serves two primary objectives. First, it identifies stolen vehicles, stolen license plates, or wanted or missing persons by matching LPR data to alert lists downloaded by the California

Department of Justice (CalDOJ). Second, it allows officers to query LPR data for ongoing criminal investigations, crime prevention, and aiding in the prosecution of vehicle-related offenses.

To meet those purposes, ARJIS established a stand-alone regional server accessible to authorized agencies. This server receives and stores ALPR data, which is transferred via encrypted communications, either directly from agencies or through agency-specific servers. Scanned license plate data is stored in the stand-alone regional server, which meets FBI Criminal Justice Information Services (CJIS) and CalDOJ requirements. This ARJIS server is not connected to any other system or network. Access to LPR data is restricted to situations where there is reasonable suspicion of criminal activity and a legitimate need to know.

Law enforcement agencies, even those without their own ALPR readers, can subscribe to commercial ALPR services. If an agency uses a particular vendor's ALPR system, they may have access to nationwide ALPR data from other entities using that same vendor's systems, subject to information-sharing agreements.

As communities, homeowner associations, retail establishments, parking facilities, and toll authorities embrace ALPR for business and security practices, some law enforcement agencies establish ALPR networks with these entities to integrate that license plate data into the agency's ALPR system or to use for independent investigative leads. Some commercial entities allow law enforcement agencies to access and search their systems. Usage of these commercial services by law enforcement may be restricted by local or state privacy laws.

2.3 ALPR Uses

Law enforcement agencies employ ALPR systems as an investigative tool, an intelligence tool, and for traffic management systems. Because many crimes involve the use of motor vehicles, ALPR systems are an important crime fighting tool to track, identify, and investigate criminal suspects [8]. ALPR systems can alert law enforcement when captured license plate information is related to stolen vehicles, missing persons, Amber or Silver Alerts, or other investigative interests. These alerts are sometimes referred to as "Hot List" alerts (see Figure 2-5). ALPR systems help law enforcement generate leads in investigations, verify the truthfulness of suspects, use witness descriptions and partial tags to identify vehicles of interest, and help collect vehicle data at crime scenes.

Figure 2-5 ALPR Hot List Alert

Image Credit: Leonardo

Outside of law enforcement use, ALPR technology is extensively used for toll collection, parking management, property management, and neighborhood watch and other community safety programs. While systems specialized for these uses are not detailed in this market survey report, the license plate data gathered from those sources, in certain cases, can be incorporated into law enforcement-based ALPR systems.

2.4 Use of Grant Funds for Certain Telecommunications and Video Surveillance Equipment or Services

The John S. McCain National Defense Authorization Act for Fiscal Year 2019 (NDAA), Pub. L. 115-232, Section 889 (NDAA) prohibits the use of federal funds, including loan and grant[4] funds, to obtain or acquire certain telecommunications technologies manufactured by certain entities or to enter into contracts with entities that use those technologies. The Office of Management and Budget (OMB) published regulations at 2 C.F.R. § 200.216 to clarify the application of the NDAA to the use of federal grant funds to procure or obtain certain telecommunications equipment or services.

Effective August 13, 2020, federal grant recipients and subrecipients (i.e., **non-federal entities**) are prohibited from obligating or expending loan or grant funds to procure or obtain[5] the following "covered telecommunications equipment or services":

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities)

For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by:

- Hytera Communications Corporation

[4] This also includes cooperative agreement funds.
[5] Nor may they extend or renew a contract to procure or obtain or enter a contract to procure or obtain the covered equipment or services.

- Hangzhou Hikvision Digital Technology Company
- Dahua Technology Company
- or any subsidiary or affiliate of such entities
- Other entities identified by the Secretary of Defense

The restriction also applies to systems that use the covered equipment or services as a substantial or essential component, and to subsidiaries or affiliates of those listed above[6]. See www.federalregister.gov/d/2020-17468/p-877.

Costs associated with covered equipment and services are "unallowable" for grant funding. Grant recipients are responsible for ensuring funds are used only for allowable costs, and would be obligated to refund the government for unallowable costs. The Federal Emergency Management Agency (FEMA) issued FEMA Policy #405-143-1, Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services (Interim) for further guidance on the Section 889 prohibitions. Additionally, OMB issued frequently asked questions (FAQs) on the topic.

For **federal** entities, FEMA published interim rules amending the Federal Acquisition Regulation[7].

2.5 Cybersecurity Considerations

The primary cybersecurity concerns for ALPRs are input validation, i.e., the integrity of the data created from the pictures taken of the license plates, and the security of that data. Security can be divided into protecting the ALPR systems themselves, encrypting the data collected and access controls that define who can access the data.

Security of the ALPRs in real-time is the first step of security, and one that has been overlooked by ALPR users in the past. "Real-time," here is defined as the information that the ALPRs collect as it occurs before it is analyzed or transmitted. ALPR users have not always enforced security on the real-time collection of data, allowing it to be accessible to anyone. For instance, in 2015 the Electronic Frontier Foundation (EFF) reported on more than 100 ALPRs that allowed anyone with an internet-connected browser to access the real-time feed of data, potentially allowing for the recording or modification of the video stream [9]. Ensuring the ALPR feeds are only accessible to authorized personnel is the first step to ensuring the data is secured. It also includes implementing cybersecurity best practices such as not using default credentials, employing a strong password policy for accessing the ALPRs, ensuring the ALPR or its gateway is behind a firewall, and system hardening to reduce the number of open ports that could be used to access the ALPRs.

The pictures taken by ALPRs are turned into data that can be read by computers by OCR. OCR turns the photo of a license plate into computer-readable text and data that can be saved to a computer or server. Before the data is saved, however, it must be verified to ensure it accurately represents the license plate in the photo. That validation ensures the text is solely the text characters on the license plate, and not any additional text that may corrupt the data or the computer storing the data. This input validation is necessary as there have been attempts to defeat ALPRs by printing or painting computer commands onto license plates that if turned into text could corrupt or delete the databases storing the text. Once the data has been verified and contains no malicious information

[6] As well as telecommunications or video surveillance services provided by entities or using equipment described above.
[7] www.federalregister.gov/documents/2019/12/13/2019-26579/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video and www.federalregister.gov/documents/2019/08/13/2019-17201/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video.

that could corrupt the data, it is transmitted to systems and databases, where it is stored for a fixed duration set in accordance with agency policies.

The second step, security of the data, includes safeguarding the transmission and storage of the data. Security during transmission and in storage is achieved through encryption and access controls, which entails allowing only the necessary and qualified personnel to access the information. There are many encryption standards available for securing data such as National Institute of Standards and Technology (NIST) standards and guidelines for data security. The most popular current standards for encryption are the Advanced Encryption Standard (AES) and Public-Key Encryption [10] [11].

Another facet of security for the ALPR data is the duration of storage. Federal, state, and local laws may dictate the duration of storing the data. Like any data, a shorter storage duration indicates a smaller likelihood of the data being exposed in a data breach. New Hampshire, for example, erases the ALPR data within three minutes of it being taken and analyzed [12].

Complementary to encrypting the data is ensuring that only authorized and necessary personnel can access the data. This is done via access control. Access control is a collection of policies that govern who can access data and applications within an organization's network. Access control is based on who needs access to the information, and can be authenticated against several facets, such as user, role, or the specific resource trying to be accessed. Access control is imperative because poor access control can allow a malicious actor to bypass even the strictest security policies used in other parts of the network, such as firewalls and anti-virus. Common types of access control include Discretionary Access Control (DAC), Attribute-Based Access Control (ABAC), Mandatory Access Control (MAC), and Role-Based Access Control (RBAC). More information on access control can be found on the NIST page for access control [13].

2.5.1 Privacy and Accuracy Concerns

Concerns about privacy, overcollection, misuse, and the accuracy of ALPR technology have been raised by civil rights groups. According to the American Civil Liberties Union (ACLU), enormous databases of innocent motorists' location information are growing rapidly, and this data is often retained for years, or even indefinitely, with few or no restrictions to protect privacy rights [14].

When used for law enforcement applications, ALPRs must ensure evidence is properly captured, stored, and managed. Governing rules of evidence require that video and audio evidence portray events fairly and accurately. This requirement can typically be satisfied by testimony from the manufacturer regarding proper operation and handling of their equipment and testimony from the officer that the video accurately represents the event as it occurred. As such, agencies should understand any relevant federal, state, and local laws governing ALPR use, retention, and dissemination to protect privacy, civil rights, and civil liberties in the collection, receipt, access, use, dissemination, retention, and purging of license plate reader information before purchasing ALPRs if intending to use recorded images and video as a third-party witness [15].

2.6 Emerging Technologies

ALPR technology has existed for over 50 years. While hardware continues to improve, emerging ALPR technology focuses on the software in terms of computer vision, machine learning, AI, and image processing. AI is advancing applications such as real-time crime predication and traffic patten analysis. Other technological improvements to ALPR systems include the continued integration of

other public and private ALPR data into law enforcement systems as well as the continued placement of additional ALPR hardware to saturate an area in coverage.

ALPR is becoming a critical component in predictive policing, a practice which aims to use historic and real-time data to inform the allocation of police resources. For example, one southwestern U.S. city with high auto-theft rates had been able to track only the locations where cars were stolen and then recovered. By using ALPR data, the police became able to analyze the movements of the stolen cars and discovered a link between car thefts and drug users trading the stolen cars for drugs in an ad hoc underground economy. As a result, police resources were targeted to address both the car thieves and drug dealers that were facilitating the thefts [16].

2.7 Standards, Policies, and Certification Programs

ALPR hardware and software adhere to specific standards across various domains, including implementation guidance, data security, data interoperability, and camera specifications. Agencies should prioritize effective operational policies, stringent data protection, seamless data sharing, and high-quality, rugged cameras for accurate license plate capture and recognition.

2.7.1 International Association of Chiefs of Police (IACP) Implementation Guidance

In 2012, the IACP published "Automated License Plate Reader Systems: Policy and Operational Guidance for Law Enforcement," to provide policy recommendations and operational guidance for law enforcement agencies regarding ALPR systems. Recommendations include that agencies should establish clear policies for managing hot lists and regularly review and update these lists for accuracy. Additionally, agencies need to define retention periods for ALPR data, limit access to authorized personnel, and address privacy concerns related to ALPR technology to protect individuals' privacy rights. For more detailed information, refer to the full document posted on the IACP's website [17].

2.7.2 Data Security

- FBI CJIS Security Policy (CJISSECPOL)

  According to the FBI, "The essential premise of the CJISSECPOL is to provide appropriate controls to protect the full lifecycle of Criminal Justice Information (CJI), whether at rest or in transit. The CJISSECPOL offers guidance for the creation, viewing, modification, transmission, dissemination, storage, and destruction of CJI. This policy applies to every individual – contractor, private entity, noncriminal justice agency representative, or member of a criminal justice entity – with access to or who operates in support of criminal justice services and information [3]."

  CJISSECPOL outlines specific security requirements for organizations handling criminal justice information. These requirements cover areas such as access control, encryption, audit trails, and personnel screening. While CJIS itself does not issue certifications, organizations can demonstrate compliance by adhering to its guidelines. Some states may have additional certification processes related to CJIS compliance, but the policy itself serves as a framework for safeguarding sensitive data in law enforcement and related agencies.

  - For purposes of the FBI CJIS Security Policy, ALPR video and images are often considered criminal justice information. Therefore, organizations subject to CJISSECPOL must ensure ALPR images, video, and data is stored and disseminated in accordance with the policy.

This includes storage on local infrastructure and in any cloud-based service provided by the manufacturer or a third party [18].

- California's ARJIS meets both the CalDOJ California Law Enforcement Telecommunications System (CLETS) and FBI CJIS Security Policies, which include certified Federal Information Processing Standard (FIPS) 140.2 compliance (which addresses computer security [19]), antivirus, and mobile device management software.
- The most recent update of the CJISSECPOL includes a multi-factor authentication (MFA) requirement to be implemented and subject to audit as of October 1, 2024, [20]. MFA must be in place for any systems accessing criminal data. In terms of ALPR usage, agencies may rely on MFA features of the ALPR product when accessing ALPR data. If the product does not include MFA features, then agency-issued devices used to access ALPR data should include a third-party MFA solution. Personally owned devices generally should not be used to access ALPR data unless the ALPR software includes MFA.

- **Federal Information Processing Standard (FIPS)**

  The Federal Information Processing Standards (FIPS) were created and are maintained by NIST to ensure the security and reliability of computer systems, particularly those involving encryption and cryptographic modules. FIPS 140-3, which supersedes FIPS 140-2, outlines specific security requirements for cryptographic modules used to protect sensitive information [21]. It became effective on September 22, 2019. Unlike FIPS 140-2, which directly specified module requirements [19], FIPS 140-3 now references International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) standards, specifically ISO/IEC 19790:2012. While FIPS 140-2 modules can remain active until September 21, 2026, organizations are encouraged to consider both FIPS 140-2 and FIPS 140-3.

- **International Justice and Public Safety Network, also known as "NLETS"**[8]

  The International Justice and Public Safety Network is a secure, encrypted network connecting law enforcement agencies across the United States, Canada, and the International Criminal Police Organization (INTERPOL) in Lyon, France. It facilitates real-time communication and information sharing among agencies, allowing them to exchange criminal justice data, plate information, driver's license details, and other critical data. NLETS is sponsored and supported by various state, local, and federal law enforcement agencies, with the bulk of the funding coming from user fees [22].

2.7.3 Data Interoperability

- **National Information Exchange Model (NIEM)**

  The NIEM is an open standards-based approach for defining information exchange specifications. Originally developed for law-enforcement data exchanges, it now provides a common vocabulary for structured, machine-to-machine data exchange across diverse public and private organizations. NIEM consists of a core data model shared by all communities using NIEM, along with community-specific elements aligned to individual domains. For instance, when discussing maritime information, NIEM ensures that terms like *vessel*, *boat*,

[8] The acronym "NLETS" was derived from the organization's previous name, the National Law Enforcement Telecommunications System. Though the organization's full name has changed, they retain "NLETS" as their preferred abbreviation, e.g., "NLETS is the International Justice and Public Safety Information Sharing Network" [22].

ship, and *conveyance* have consistent meanings across agencies. This model streamlines information sharing, saving time and resources while promoting effective communication [23].

- Open Geospatial Consortium

  The Open Geospatial Consortium (OGC) is an international association that develops and implements interoperable standards for geospatial data and services, ensuring they are findable, accessible, interoperable, and reusable (FAIR). OGC's collaborative process involves a diverse membership, including Fortune 500 organizations, governments, academic hubs for innovation, startups, and more. This diversity helps ensure that standards represent various users' perspectives and leverage cutting-edge technology. OGC standards are available at www.ogc.org/standards.

- Open Network Video Interface Forum (ONVIF)

  The ONVIF is a global industry forum founded in 2008 by Axis Communications, Bosch Security Systems, and Sony to develop a universal standard for the network interface of IP-based security products. ONVIF provides standardized profiles for functionalities such as access control, video streaming, and metadata management. These profiles ensure interoperability between devices from different manufacturers, making integration more efficient and reliable. In ALPR systems, ONVIF ensures compatibility and seamless communication between various components, enhancing interoperability and ease of integration [24].

2.7.4 Camera

- Ingress Protection (IP) Rating

  Standards for IP are defined by the International Electrotechnical Commission (IEC) 60529 [25]. This standard classifies the degree of protection provided by mechanical casings and electrical enclosures against the intrusion of dust and liquids. A table providing a full explanation of IP ratings can be found in Appendix A.

3.0 PRODUCT INFORMATION

This section provides information on ALPRs, which are listed alphabetically by manufacturer. All products listed are COTS ALPR products that are NDAA- and CJIS-compliant. Table 3-1 provides an overview of general characteristics and specifications of the products as provided by the manufacturer. Sections 3.1 through 3.16 provide more details about each product. Appendix B describes specifications for associated camera hardware. The information in section 3.0 has not been independently verified by the SAVER program.

Below are definitions of the product information in Table 3-1, listed in column order.

Capture Rate is the percentage of license plates that the ALPR system can successfully detect out of all vehicles passing the ALPR camera.

Read Rate is the percentage of license plates read correctly out of the total number of plates presented to the ALPR system.

Server-based refers to systems that can be hosted on a local on-premises server.

Cloud-based refers to systems that can be based in the cloud.

Camera Agnostic refers to systems that can use outside companies' Internet Protocol (IP) cameras and do not depend on dedicated ALPR cameras.

Fixed Cameras refers to systems that offer dedicated fixed cameras.

Portable Cameras refers to systems that offer dedicated cameras designed for easy mounting and deployment.

Vehicle-Mounted Cameras refers to systems that offer dedicated vehicle-based mobile cameras such as dash-mounted cameras.

Cellphone-Based Cameras refers to systems that allow users to upload photos/video from cellphones and may have dedicated mobile apps that allow image upload, ALPR notification, and/or ALPR inquiries.

Table 3-1 Product Comparison Matrix

Manufacturer, Product	Capture Rate	Read Rate	Server-based	Cloud-based	Camera Agnostic	Fixed Camera	Portable Camera	Vehicle-Mounted Camera	Cellphone-Based Camera
3dEYE Inc., 3dEYE ALPR	99.0%	99.5%	×	✓	✓	×	×	×	✓
Axon Enterprise Inc., Axon Fleet 3 with ALPR	>90%	>90%	✓	✓	×	×	×	✓	×
Flock Safety, FlockOS	97%	93%	×	✓	×	✓	✓	×	✓
Genetec, Security Center AutoVu	98.6%	97.8%	✓	✓	×	✓	✓	✓	✓
Insight LPR LLC, MX Guardian	>96%	>98%	×	✓	×	✓	✓	×	✓
iOmniscient Corporation, iQ LPR	99.0%	98.5%	×	✓	✓	×	×	×	✓
Jenoptik Smart Mobility Solutions, VECTOR ALPR System	99.5%	98.0%	×	✓	×	✓	✓	✓	✓
Leonardo US Cyber & Security Solutions LLC, ELSAG LPR	>95%	>95%	✓	✓	×	✓	✓	✓	✓
Motorola Solutions, Vigilant VehicleManager LPR	NP	NP	✓	✓	×	✓	✓	✓	✓
NeuroCar, NeuroCar VI	>98%	>97%	NP	NP	✓	×	×	×	✓
ParkPow, Inc., Plate Recognizer	>99%	>99%	✓	✓	✓	×	×	×	✓
PLATELOGIQ, Vehicle Intelligence and Plate Recognition (VIPR)	99.4%	98.1%	×	✓	×	✓	×	✓	✓
PlateSmart Technologies, ARES 3.0/Mobile Defender	>98%	>98%	NP	✓	✓	×	×	×	✓
Rekor Systems Inc., Scout	99%	>98%	×	✓	×	✓	×	×	×
Safe Fleet, Focus H2 with ALPR	>98%	>98%	×	✓	×	×	×	✓	×
Utility, Pulsar and Rocket	NP	NP	×	✓	×	✓	×	✓	×

✓ indicates that the feature is available × indicates that the feature is not available NP indicates that the data is not provided

3.1 3dEYE Inc., 3dEYE ALPR

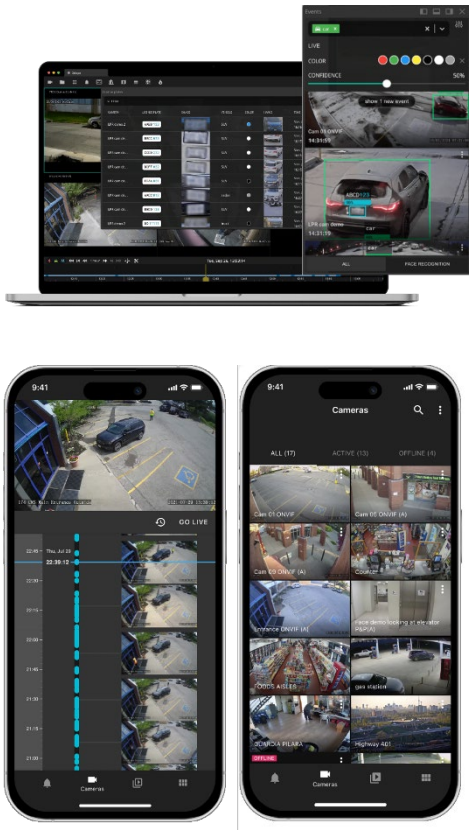

Figure 3-1 ALPR Analytics in 3dEYE's Cloud Video Portal User Interface (top) and Mobile App Views (bottom)
Image Credit: 3dEYE

Image Processing Data Outputs	License plate number, vehicle make, category, color.
Capture Rate	99%
Read Rate	99.5%
Hot list Info	Hot lists and readings can be manually created, uploaded as files, or sourced from third-party systems and databases via API.
How to Access Software	Accessible via web and mobile apps. Multi-factor authentication is available for secure access.
Data Storage and Middleware	The ALPR module uses Amazon Web Services (AWS) S3 for data storage, with an option for AWS GovCloud for added security. Data sharing is permission-based, with administrators granting camera access. Sharing options include widgets, URLs (which can be password-protected and have expiration dates), and inter-organizational sharing.
Notifications and Searches	Custom alerts for license plate detection or vehicle details. Notifications can be delivered via push notifications, emails, webhooks, and APIs. Users can view all notifications through the platform. Search parameters include vehicle tags, partial tags, make, model, and color, filterable by area, date.
Third Party Interoperability	Compatible with record management systems via API. Compatible with third party cameras.
Compatible Hardware	Compatible with third party IP cameras, edge AI devices with ONVIF Profile M protocol, and smartphone images via API.
Cybersecurity	AWS Identity and Access Management used to anonymize data and restrict access. Data is encrypted in transit and at rest. AWS GuardDuty and SecurityHub prevent data loss and unauthorized access. AWS detection and network tools provide firewall protection. Software compliant with the General Data Protection Regulation of the European Union.

- **Software components and functions**: The 3dEYE ALPR module is designed to work with any IP camera. The system processes images using deep neural network algorithms to extract alphanumeric characters, as well as appending the date and time of capture. Use of AWS enables scaling based on demand and enables users to access data and analysis results from anywhere with an internet connection. Analytics can be activated for individual cameras.
- **Pricing and support:** Pricing for the 3dEYE ALPR module is based on either a subscription or a consumption model, with different plans available to suit various needs. For example, a data plan with a 7-day archive and 1 Mbps bitrate costs $4.85 per camera per month, the advanced analytics package costs $8, and the ALPR add-on costs $24, totaling $36.85 per camera per month. This includes standard support, training, and certification. 3dEYE provides full product training at no additional fee, and technical support is available to ensure customers receive the assistance they need.

3.2 Axon Enterprise Inc., Axon Fleet 3 with ALPR

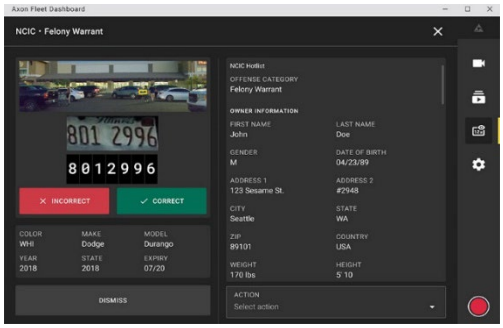

Figure 3-2 Axon Fleet 3
LPR software interface (top), vehicle camera (bottom)

Image Credit: Axon

Image Processing Data Outputs	Only plate numbers for all 50 states. "Vehicle Fingerprint" analytics (color, make, body type, and decals) available if integrated with FlockOS (see Section 3.3).
Capture Rate	>90%
Read Rate	>90%
Hotlist Info	Can import national or state hot lists via Axon Evidence. Can also create custom agency hot lists through CSV via Axon Evidence. Custom hot lists only accessible by the creating agency.
How to Access Software	SaaS platform. Axon Fleet Dashboard accessible on mobile data terminals. Axon FususOps mobile app available. MFA required to access software.
Data Storage and Middleware	Cloud-based data storage
Notifications and Searches	Alerts delivered through Axon Fleet dashboard app or FususOps. Email and text alerts also available. Users can review plate hits captured during a shift, hotlist source, plate number, and verify accuracy of plate read.
Third Party Interoperability	Can import and export plate read records with Flock Safety ALPR (see Section 3.3) [26]. Flock integration adds additional image processing outputs.
Compatible Hardware	Axon Fleet 3 Vehicle Camera system. More information on this camera is included in Appendix B.
Cybersecurity	Evidence data encrypted at rest using CJIS-compliant NSA Suite B 256-bit AES encryption

- **Software components and functions:** The primary interface with the software is through the Axon portal installed on in-car computers/mobile data terminals running Axon's Fleet Dashboard and integrates with the overall Axon platform. The software features live streaming, live maps and ALPR alerts. The Fleet Dashboard provides a user interface for managing cameras, viewing live feeds, video recording, video storage, wireless communication, tagging evidence, and accessing ALPR alerts.
- **Pricing and support**: The software and camera are priced at $59/month per single in-car video camera or bundled at $235/month over 60 months with Axon's Fleet 3 Advanced offering. Axon offers customer-site training for an additional cost for the use of their ALPR and Fleet products. Axon has a technical support division, composed of 37 full-time team members, who are responsible for supporting their entire line of products. Live phone support is available 24-hours a day, seven days a week, including holidays. For hardware products, Axon provides a limited warranty that covers defects in workmanship and materials for one year from the date of receipt. This includes Axon-manufactured devices. Axon-manufactured accessories are covered for 90 days from the date of receipt. Extended warranties are available for purchase.

3.3 Flock Safety, FlockOS

Figure 3-3 Flock Safety ALPR
FlockOS (top), Flock Safety Wing (middle), Falcon LR camera (bottom left), Falcon SR camera (bottom middle), Falcon Flex camera (bottom right)

Image credit: Flock Safety

Image Processing Data Outputs	Vehicle license plate numbers for all 50 states as well as Canadian and Mexican plates, vehicle images, vehicle characteristics, as well as the date, time, and location of image collection. "Vehicle Fingerprint" feature enables color, make, body type, and decals (e.g., Uber, bumper stickers).
Capture Rate	98% (single lane configuration), 97% (two-lane) with Falcon LR camera
Read Rate	93% with Falcon LR camera
Hotlist Info	Can import NCIC hot lists and state police hot lists; user can create custom hot lists
How to Access Software	Camera feeds access through FlockOS dashboard. Mobile version of software available for iOS and Android. Agencies assign administrators who can grant other personnel within the agency access to record of plate reads. MFA can be enabled. All logins are recorded for auditing purposes.
Data Storage and Middleware	Uses AWS GovCloud to store all CJIS data. No CJIS data is shared with non-law enforcement Flock Safety customers.
Notifications and Searches	Alerts generated when a plate reading results in a hotlist match. Search parameters include plate numbers, make, model, color.
Third Party Interoperability	Compatible with Axon and Genetec cameras. Can import and export data from Axon and Genetec ALPRs.
Compatible Hardware	Compatible with Flock Falcon LR camera, Flock Falcon SR, Flock Falcon Flex, and other cameras manufactured by Flock Safety. Also compatible with Axon and Genetec cameras. Live and recorded video integration through Flock Safety Wing software.
Cybersecurity	Information not provided by vendor

- **Software components and functions:** FlockOS is a situational awareness application that integrates all Flock devices into a cloud-based map view. FlockOS is available to law enforcement in three different service levels: Essentials, Advanced, and Elite.
  - Essentials: Provides access to shared third-party cameras, access to the Flock LPR state and nationwide networks, direct sharing with surrounding jurisdictions, Vehicle Fingerprint search features (time/location, license plate), Environmental Systems Research Institute (ESRI) map interface, real-time NCIC alerts, custom hot lists, unlimited users, and transparency portal (i.e., a portal that allows the public to access police ALPR policies and usage statistics).
  - Advanced: Includes all features of the Essentials level and adds the Wing Gateway, Wing Cloud, and Wing VMS; incorporates Axon body worn cameras and Fleet location, custom map layers, and community camera access. Advanced level also includes a single sign-on feature which allows users to sign into their accounts using existing credentials from any Security Assertion Markup Language (SAML) provider or custom authentication API. This makes the sign-on process more flexible and saves time.
  - Elite: Includes all the features of the Essential and Advanced levels and adds real-time routing, drone video, floor plans, and other features.
- **Pricing and support**: Pricing information not provided by vendor. Flock Safety provides maintenance of cameras for a subscription fee.

3.4 Genetec, Security Center AutoVu

Figure 3-4 Genetec AutoVu
Sharp Z3 camera (top), Sharp V camera (bottom left), Cloudrunner CR-H2 camera (bottom right)

Image credit: Genetec

Image Processing Data Outputs	License plate number, state, country, make, model, color, type, speed estimation, direction of travel.
Capture Rate	98.6%
Read Rate	97.8%
Hotlist Info	NCIC support, custom upload, local or remote file import, manual or scheduled automatic list imports
How to Access Software	AutoVu Managed Services software can be installed on local servers, mobile devices or accessed through a web client or web application. Web client supported by Microsoft and Apple operating systems. Software compatible with third party solutions to enable MFA.
Data Storage and Middleware	Data can be stored on local drives, network drives, and cloud servers. Cloud servers hosted by Microsoft Azure. Agency data stored on cloud servers is only accessible by the agency. Agency can also specify data retention period for cloud servers.
Notifications and Searches	Provides real-time and historical vehicle activity monitoring and alerts for full plate numbers, partial tags, and vehicle description with alerts by email, text, or delivered in app. Hot list notification, geofencing, and frequent vehicle detection alert. Search for vehicle tag, partial tag, make, model, color, location, date.
Third Party Interoperability	API for integration with various systems including records management. Security Center app allows users to share data with external partners. Users can grant different levels of access to external partners.
Compatible Hardware	Compatible with Genetec Sharp V, Sharp Z3, and Cloudrunner CR-H2 cameras (see Appendix B). Also compatible with smartphone cameras through Mobile AutoVu Plate Finder app.
Cybersecurity	Communication, including ALPR reads and hits, between cameras, data servers, and patrol vehicles are encrypted.

- **Software components and functions:** Autovu is one component of Genetec Security Center, a security platform that also includes video surveillance and access control. The AutoVu system captures cross-references license plate reads and matches alongside video footage of incidents, contextual images, and GPS information. AutoVu allows agencies to define user access privileges, control how long ALPR images and data are kept, and select the ALPR information shared with other agencies.
- **Pricing and support:** Single purchase or subscription-based plans are available. The Cloudrunner CR-H2 camera system is available by annual subscription. The Cloudrunner subscription includes full replacement warranty, customer support, upgrades, and cellular service.

3.5 Insight LPR LLC, MX Guardian

Figure 3-5 Insight MX Guardian ALPR
MX Guardian software (top), Matrix Edge camera (2nd down), MX Defender camera (3rddown), MX Defender S camera (bottom)

Image credit: Insight LPR, LLC.

Image Processing Data Outputs	License plate number, make, model, color, last-seen location, reason for being on hotlist.
Capture Rate	>96%
Read Rate	>98%
Hotlist Info	Custom hot lists which can be synchronized with NCIC lists, local agency lists
How to Access Software	MX Guardian software can be installed on an agency computer or accessed through web-based interface; MX Connect mobile app available for iOS operating systems (Android in development). Administrators can enable two-factor authorization and different access levels to software and data.
Data Storage and Middleware	Data stored in Azure Government Cloud. Image processing and extraction of LPR information is handled on Insight cameras.
Notifications and Searches	Notifications sent via text, email, or delivered in app. Search parameters include plate number, partial plate number, make, model, and color.
Third Party Interoperability	Open API for integrating with external agencies' data bases and with third party LPR databases.
Compatible Hardware	Compatible with Insight Matrix Edge, Insight MX Defender, Insight MX Defender S (see Appendix B). Also compatible with smartphone cameras through MX Connect mobile app.
Cybersecurity	Transmitted data encrypted using TLS 1.2; data stored on cloud servers encrypted using Microsoft Azure security modules. Administrators can restrict access to software and data. Camera remote management restricted via on-device firewall.

- **Software components and functions:**
  - MX Guardian compiles and manages captured data, providing users with analytics. It also controls camera deployment options and helps to identify vehicles of interest.
  - MX Connect is an iOS mobile app designed to provide law enforcement officers with real-time alerts from fixed and mobile cameras, allowing organizations to connect without the need for a laptop and offering location-based notifications.
- **Pricing and support**: Each camera model can be purchased for $7,500 including software. Alternatively, Insight offers a $3,500/year/camera subscription. Insight LPR has a full-time Customer Success Manager available Monday through Friday from 8 am–5 pm CST and offers technical support through email or phone Monday through Friday from 7 am–6 pm CST. The standard warranty is one year from purchase, while the subscription-based model has a warranty or the length of the contract.

3.6 iOmniscient Corporation, iQ-LPR

Figure 3-6 iQ-LPR interface

Image credit: iOmniscient

Image Processing Data Outputs	Plate number, make, model, color, special and custom plates for all 50 US states and 130 countries. Advanced features include accident detection, vehicle traveling in wrong direction, vehicle speeding, vehicle in bus lane, and vehicle dwell time between two locations.
Capture Rate	99% for vehicles traveling up to 155mph
Read Rate	98.5-99.5% for vehicles traveling up to 155mph
Hotlist Info	An agency can create a hotlist by either uploading a CSV file of vehicle of interests or manually enter them individually.
How to Access Software	iQ-LPR software access through desktop app; iQ-Mobile access via mobile application.
Data Storage and Middleware	Data stored on edge devices, physical servers, agency cloud servers, or iOmniscient private cloud server.
Notifications and Searches	Accident, hotlist, and plate match alerts sent via email, text, XML, and/or the desktop and mobile apps. Search by plate number, make and mode, last seen location, and reason on hotlist.
Third Party Interoperability	System can process data from ONVIF-compliant external video cameras.
Compatible Hardware	Compatible with iOmniscient Analytics Ready LF005, LF006, LF013, and LF101 cameras. (See Appendix B).
Cybersecurity	Server and client systems have encrypted handshake.

- **Software components and functions:** iQ-LPR uses an intelligent, multi-image, neural network to recognize vehicle license plates from images and videos. The software includes various analytics modules, such as make and model detection, vehicle color detection, vehicle classification, and incident management (such as accidents, wrong direction, and speeding).
- **Pricing and support:** Pricing is subscription-based, with subscription or one-time purchase options. Users can pay up front for a license and then pay an annual subscription fee to maintain it, or they can pay nothing up front and pay a charge per day for using the software. The MSRP for the LF005 camera is $440; the LF006 camera, $345; the LF013, $750; and the LF101 camera, $6,375. iOmniscient offers 24x7 global support tailored to the customer's service level requirements. Operator and administrator training are available. All products come with a 12-month warranty, including regular updates/upgrades and technical support. One-year warranty for camera includes protection against manufacturing defects.

3.7 Jenoptik Smart Mobility Solutions, VECTOR ALPR System

Figure 3-7 Jenoptik VECTOR camera
Image Credit: Jenoptik

Image Processing Data Outputs	License plate numbers, vehicle make, model, color, features such as toolboxes, luggage racks, vehicle stickers or decals (e.g., Uber, bumper stickers).
Capture Rate	99.5%
Read Rate	98%
Hotlist Info	NCIC, state, and local hot list databases automatically uploaded to TraffiData, the system's web-based application. User can also manually enter individual plate numbers or upload CSV files.
How to Access Software	Accessible via the web using a desktop, laptop, or any smartphone device. Additionally, TraffiApp provides mobile access. A designated administrator within the agency can define who can view, share, or restrict the ALPR data.
Data Storage and Middleware	Uses CJIS-compliant cloud-based storage as the preferred method, but on-site storage is available as well. Data can be shared with outside agencies with an MOU.
Notifications and Searches	Provides hot list alert notifications within five seconds via text to mobile devices and through email. Alerts include license plate information, hot list name, location, date, and time.
Third Party Interoperability	Integrates with third-party cameras from Genetec, PIPS, Drive Off Alert, Motorola Vigilant, Flock Safety, NDI-RS, and Leonardo ELSAG.
Compatible Hardware	Jenoptik offers the Vector camera (see Appendix B). TraffiData integrates with third-party cameras as listed above.
Cybersecurity	Data encryption, user authorization, input validation.

- **Software components and functions**: TraffiData is Jenoptik's ALPR web-based application that classifies vehicle types, records license plates, and extracts information from images. TraffiData integrates with ALPR cameras, providing real-time data analysis. TraffiApp is a mobile ALPR application that provides secure, encrypted real-time connections to TraffiData. Alerts from static cameras are possible using GPS geo-zoning.
- **Pricing and support**: TraffiData is sold as software-as-a-service (SaaS) with annual licenses per camera or as single licenses per agency. The Vector camera, which has an MSRP of $16,957.95, is available on the GSA schedule (47QSWA23D00A8) and comes with a one-year full warranty. Additional warranties for 2–5 years can be purchased for approximately $1,400 per year. Full and complete software and hardware training are provided to the customer with purchase. Jenoptik customer service is available from 8 am to 5 pm EST and during designated after-hours support.

3.8 Leonardo US Cyber & Security Solutions LLC, ELSAG LPR

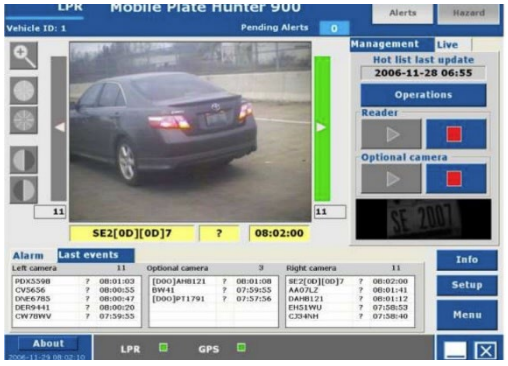

Figure 3-8 Leonardo ELSAG Enterprise Operations Center, (top) Mobile Plate Hunter, F4 Fixed, Street Sentry Solar, and VPH 350 (clockwise from top left)

Image Credit: Leonardo US Cyber and Security Solutions LLC

Image Processing Data Outputs	Plate number, vehicle color, make, model, type, and features like roof racks and bumper stickers, date/time stamps, GPS coordinates, and license plate images.
Capture Rate	>95%
Read Rate	>95%
Hotlist Info	Supports unlimited lists, which can be downloaded from sources like FBI CJIS, state police, or local databases or created manually. Lists can be made using a web tool, CSV upload, or automated updates (based on system rights). Lists are updated from Leonardo's ELSAG Enterprise Operations Center (EOC) software server to edge devices for real-time alarm processing.
How to Access Software	EOC software, web interface, mobile app.
Data Storage and Middleware	ELSAG EOC can operate in the cloud or physical servers on premises, behind an agency's firewall, and without internet access. Agencies own their ALPR data, which ELSAG does not access, share, or sell. The system provides extensive audit and system logging, with all user actions being auditable.
Notifications and Searches	Alerts officers with audible and visual alarms for hot list matches, customizable based on mission needs. Alarms are displayed on the software screen with an audible alert. Remotely monitored systems use the EOC Dispatcher function for real-time alarms. EOC can process alarms at the server level if edge devices lack processing capability. Users can receive alarms via email or text.
Third Party Interoperability	Supports third-party interoperability through APIs that facilitate the ingestion of ALPR data from various systems. Leonardo's Video Plate Hunter (VPH) software processes external video cameras for ALPR data, with success depending on camera quality, lighting, and aiming.
Compatible Hardware	Compatible with ELSAG Mobile Plate Hunter, F4Fixed, Street Sentry Solar, and VPH 350 (and other VPH fixed models).

	Cybersecurity	Encryption for data in motion and at rest, using Microsoft SQL Server encryption, file system services, and TLS 1.2/SSL. It supports SQL-based and LDAP authentication, two-factor authentication, and various security features, with VPN or encrypted tunneling for secure communication.

- **Software components and functions**: The ELSAG Enterprise Operations Center (EOC) software integrates fixed, portable, and vehicle-mounted ALPR cameras to support law enforcement. EOC collects ALPR data from all units and distributes hot lists to field cameras. It offers tools for data mining, mapping, and vehicle recognition by make, model, and color. The system can search using partial tags, wild cards, vehicle features, stickers, geography, location, and time. Advanced options include cross searches for common plates and convoy searches. The Leonardo smartphone app provides access to queries, real-time alarms, and ALPR data capture.
- **Pricing and support**: Leonardo offers both SaaS and single purchase options for their ALPR software, customized to customer needs. Software licenses vary by hardware type (see Appendix B): $1,250 for two vehicle-mounted systems, $800 for a solar LPR system, $1,275 for an F4 fixed camera, and $600 for a VPH camera. SaaS costs depend on data usage and customizations, with a base rate of $2,400 per terabyte (TB) per year or $650 per LPR system. The standard warranty is one year, with extended warranties available. Training includes manuals, slides, and in-person or remote instruction. ELSAG EOC software provides remote data access and 24/7 technical support.

3.9 Motorola Solutions, Vigilant VehicleManager LPR Software

Figure 3-9 Vigilant VehicleManager (top to bottom: Software, Mobile Companion, L6Q Quick Deploy, L5F Fixed, and L5M Mobile)

Image Credit: Motorola Solutions

Image Processing Data Outputs	License plate numbers, vehicle make, model, color, special and customized plates, incident management (e.g., accidents, wrong-way driving, speeding) and vehicle dwell-time tracking. The system can determine vehicle speed via L6Q Quick Deploy camera.
Capture Rate	Not provided
Read Rate	Not provided
Hotlist Info	Supports hot list creation at individual, group or agency levels, with sharing and subscriptions.
How to Access Software	Cloud-based and available on any desktop or mobile device with an internet connection.
Data Storage and Middleware	Data retention is tailored to agency policies and local laws.
Notifications and Searches	The system supports email and text-based alerts, and mobile application push notifications for officers. Dispatch can use the dedicated Windows application, Target Alert Service, to receive alerts and send units to respond. Allows various plate searches, location-based searches, vehicle filtering, associate and convoy analysis, and vehicle location prediction.
Third Party Interoperability	Supports CJIS-compliant data management, agency-defined data retention, and data sharing. Built-in MOU templates facilitate collaboration with other agencies and partners. Motorola LinC Video-Based LPR integrates with various video cameras and networks, including lower quality cameras, RTSP- or ONVIF-compliant IP video streams with central or edge processing options.
Compatible Hardware	Compatible with L5F, L5M, and L6Q Motorola cameras (see Appendix B). Also compatible with third party cameras.

	Cybersecurity	Access to LPR data requires dual-factor authentication. When paired with Motorola cameras, data is secured with end-to-end encryption and hashing. Secure web browser authentication is mandatory, and agencies can limit user access. All Vigilant Mobile Companion data is erased from the device upon closing the app. All user actions are logged for auditing purposes. Regular system updates enhance security.

- **Software components and functions**: Vigilant VehicleManager is a license plate recognition and vehicle location solution designed to convert LPR data into actionable intelligence for law enforcement. It offers complete and partial plate search capabilities with date and time filters, displaying detection data in a timeline view and map with Google Street View integration. Users can search for, review, and predict vehicle location history, generate investigative leads through pattern analysis, and identify connected vehicles or locations. Convoy Analysis helps identify vehicles traveling together. Vigilant Mobile Companion is a smartphone app (Android and iOS) that allows officers to scan plates, upload vehicle images, receive real-time alerts, and conduct analytics.
- **Pricing and support**: Pricing information is available from the vendor. The Motorola training team offers on-site, virtual, and on-demand training. Customer support is available via telephone or email to troubleshoot and fix any issues. The L6Q Quick Deploy camera includes a 5-year warranty.

3.10 NeuroCar, NeuroCar VI

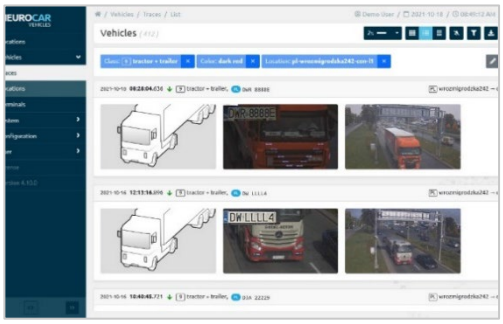

Figure 3-10 NeuroCar "Backoffice Vehicles" interface

Image Credit: NeuroCar

Image Processing Data Outputs	Can perform character recognition on license plate images for all 50 U.S. states. Time-stamped description, including license plate number, country of origin, color, make, model, stickers or labels (e.g., Uber, bumper stickers), United Nations dangerous goods pictograms, vehicle speed, and direction of travel. Also saves a pre-designated photograph of the vehicle.
Capture Rate	>98%
Read Rate	>97%
Hotlist Info	Allows for manual creation of hot lists.
How to Access Software	Accessed via a smartphone, streams from an edge device (e.g., smart camera), mobile data terminal or other computer, or cloud (Kubernetes). The software runs natively on Android devices.
Data Storage and Middleware	Uses an object-oriented database for ALPR data storage, which has a representational state transfer (REST) access interface. ALPR data control is done via API.
Notifications and Searches	Sends HTTP POST messages to a specified URL, metadata in JSON form or metadata and images in TAR form. Displays graphic/audio notifications on the user interface and can send files via FTP to a specified server. Search parameters include tag, partial tag, wildcard, vehicle make, model, color, stickers or labels (e.g., Uber, bumper stickers), country, region, plate type, United Nations dangerous goods placarding, speed, driving direction, and traffic lane.
Third Party Interoperability	Allows connection to any video source via RTSP (h.265, h.254, or MJPEG) for integration with ALPR cameras and other cameras. Also allows for third-party and enterprise ALPR data intake.
Compatible Hardware	Neurocar ANPR Camera 4; Neurocar FLOW Camera 3; any video source via RTSP

	Cybersecurity	Uses SSL protocol for secure data transfer and employs digital signatures using TPM hardware private keys for data generated by the device. Uses a dedicated API authorization module with user/password or token-based access. Utilizes TPM 2.0 and Linux-based hard disk encryption to protect data. Security updates are provided via software patches to maintain the system's integrity.

- **Software components and functions**: The ALPR system and software, NeuroCar VI, can compare the extracted data to hot lists and trigger alerts for matches. NeuroCar can receive raw images and/or processed data from ALPRs and/or cameras owned and operated by external entities.
- **Pricing and support**: Three pricing tiers are available: Simple (ALPR only), Standard (ALPR + make and model recognition (MMR)), and Extended (ALPR + MMR + Dangerous Goods + Speed). The purchase is a perpetual license per channel with quarterly updates. Customer training options include certifications, and higher-level support is available via their website or WhatsApp. The purchase includes a 12-month warranty and is extendable to 60 months at an additional cost.

3.11 ParkPow, Inc., Plate Recognizer

Figure 3-11 Snapshot ALPR Architecture
Image Credit: ParkPow, Inc.

Image Processing Data Outputs	Vehicle plate numbers, states, models, colors, orientations, travel directions, and dwell times. Can also detect stacked characters, logos, icons, handicapped tags, dirty, tinted, vanity, and reflective/non-reflective plates, while ignoring distractions like bumper stickers.
Capture Rate	>99%
Read Rate	>99%
Hotlist Info	Users can manually create hot lists. Also supports agency-specific and investigative hot lists.
How to Access Software	Plate Recognizer software can be accessed via multiple platforms. The Stream software runs on premises on Windows, Linux, Mac, or Jetson devices [27]. The Snapshot software can be accessed through the cloud or installed via the Snapshot SDK. The ParkPow dashboard is accessible both on the premises and in the cloud [28].
Data Storage and Middleware	Data stored on cloud or physical servers. ParkPow does not share ALPR data with third parties unless customers choose to share it according to their policies.
Notifications and Searches	Offers customizable alerts via email, Teams, Google Chat, Slack, Telegram, Discord, and Pushbullet [29]. Users can set notifications for specific vehicles or triggers like license plate number and vehicle make/model. Alerts can be configured to appear in specific locations on devices, and users can view all notifications through their chosen platform [30].
Third Party Interoperability	API enables integration with records management systems and third party cameras, and enables image imports via spreadsheet.
Compatible Hardware	Compatible with third party IP cameras

	Cybersecurity	Can function without internet connectivity. On-premises ALPR software stores data locally and communicates securely over HTTPS for installation and license verification. The analytics and dashboard software provide secure API access with granular permissions, validating and sanitizing input data. Regular updates every 3–6 weeks include security patches, bug fixes, and new features.

- **Software components and functions**: Plate Recognizer consists of two software products that work with any IP camera:
  - Stream processes images, video files, and live camera feeds
  - Snapshot processes static images

  Plate Recognizer ALPR software runs on a variety of hardware, including Raspberry Pi 3, without the need for a graphics processing unit (GPU). Camera integration can be done via camera real-time streaming protocol (RTSP), file transfer protocol (FTP), processing of video files, or processing of images in a folder.
- **Pricing and support**: Plate Recognizer Stream software starts at $350 per camera per year, Plate Recognizer Snapshot software starts at $50 per month for 50,000 images processed each month, and the ParkPow ALPR dashboard platform costs $20 per month per camera. Vehicle make, model, color, orientation, direction of travel, and dwell time are available at an additional cost. ParkPow also offers a perpetual software license. Warranty, technical support, machine-learning updates, and software patches/updates are all included in the subscription. ParkPow provides full product training at no additional fee. The ParkPow technical support is available around the clock during the week (Monday through Friday) and is available on weekends for urgent matters.

3.12 PLATELOGIQ, Vehicle Intelligence and Plate Recognition (VIPR)

Figure 3-12 VIPR Mobile App
Image Credit: PLATELOGIQ

Image Processing Data Outputs	License plate number, vehicle make, model, color, and features like toolboxes or luggage racks, stickers and labels (e.g., Uber).
Capture Rate	99.37%
Read Rate	98.14%
Hotlist Info	Realtime links to the NCIC hotlist plus allows for the creation and querying of an unlimited number of agency-specific hot lists for vehicles, which can include information such as the license plate number, make, model, last seen location, and the reason for being on the hot list.
How to Access Software	Can be accessed through various platforms, including web-based interfaces and mobile apps.
Data Storage and Middleware	Data storage is cloud-based or hybrid (cloud and physical).
Notifications and Searches	Notifications received via a web-based application, email, text, app push notifications, and integration with dispatch systems; they can be customized based on user-defined criteria. Search features include real-time and historical data by make, model, color, and license plate.
Third Party Interoperability	Supports importing and exporting data to and from other software systems including video from any system that supports Real-Time Streaming Protocol (RTSP).
Compatible Hardware	PlateLogiq VIPR Fixed, VIPR Fixed Long Range, and VIPR Mobile (see Appendix B) or any system that supports RTSP.
Cybersecurity	No data processing on camera. Data secured with SHA-256 encryption for data in transit and 256-bit encryption for CJIS data at rest. Authentication includes biometric (face ID) for the smartphone app and email/SMS two-factor authentication for other platforms.

- **Software components and functions**: VIPR's main application identifies vehicle attributes and license plates from captured images. The mobile app allows license plate reading from smartphones, operating at various speeds and conditions with optional infrared cameras. VIPR Unity consolidates LPR data from diverse manufacturers, ensuring compatibility and integration, with all LPR processing handled within the VIPR software.
- **Pricing and support**: VIPR offers database-only access as well as bring-your-own-camera (BYOC), per-camera, and smartphone app licensing. Pricing is SaaS-based: $2,500 per fixed camera/year and $1,250 per mobile camera/year, with upfront payment options. Training is via recorded videos and live webinars. Support is available 24/7 for critical issues, with standard hours Monday to Friday, 8:00 AM to 8:00 PM. Fixed cameras have a 5-year warranty; vehicle-mounted cameras, 3 years.

3.13 PlateSmart Technologies, ARES 3.0/Mobile Defender

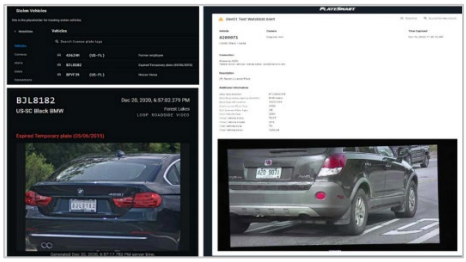

Figure 3-13 PlateSmart ARES 3.0 and Mobile Defender (top to bottom)

Image Credit: PlateSmart

Image Processing Data Outputs	License plate number, vehicle make, model, color, direction, orientation, date and time stamp.
Capture Rate	>98%
Read Rate	>98%
Hotlist Info	Create agency-specific hot lists, including license plate numbers, make, model, last seen location, and the reason for being on the hot list. Import NCIC hot lists from CJIS-compliant law enforcement networks.
How to Access Software	The web-based interface dynamically fits various screens.
Data Storage and Middleware	Storage can be either on-premises or cloud-based. Data can be shared with other agencies with an MOU.
Notifications and Searches	Alerts via text message, email, pop-up alerts, and bell notifications. Provides real-time alerts and hot list matching against national and state databases. Integrates with law enforcement databases for crime prevention. Supports offline alert and license plate search and lookup. Search parameters include tag, partial tag, wild cards, vehicle make, model, color, and features like toolboxes or luggage racks.
Third Party Interoperability	Compatible with third party IP-based camera streams with static IP V4 addresses. Export data to the cloud or on-site backend software.
Compatible Hardware	Compatible with third party IP cameras and in-car cameras from vendors such as LensLock. Does not support mobile phone cameras.
Cybersecurity	Input validation is enforced at the UI, API, and command/query handler levels. Administrators manually apply updates using provided installers and tools. ARES 3.0 includes comprehensive auditing features to monitor and enforce access, allowing administrators to review login activity, investigate failed login attempts, track user searches, and identify changes to system configurations.

- **Software components and functions:**
  - ARES 3.0: ARES 3.0 is an ALPR solution developed by PlateSmart Technologies. It integrates with strategically positioned fixed cameras for continuous license plate image capture. Key features include data processing (license plate extraction and vehicle attributes), hot list matching against national and state databases, and secure data storage. ARES 3.0 is highly scalable and can monitor unlimited cameras.
  - Mobile Defender: Mobile Defender is a built-in ALPR capture and alerting laptop system specifically designed for use in law enforcement vehicles. Its features include support for up to three cameras per vehicle, reception of alerts from fixed ALPR cameras, license plate number capture, extraction of vehicle attributes, location-aware movement tracking, automatic query of hot lists (e.g., NCIC), and encrypted data storage. It also receives alerts from other fixed ALPR cameras, enabling off-line alert and license plate search and lookup.
  - Vision: Vision is an add-on software module that links to the ARES 3.0 application. When ARES 3.0 alerts on a tag, Vision automatically indexes contextual video from associated overview cameras in the area, allowing operators to quickly find relevant footage recorded around the time of the ALPR alert.
  - Guardian: A product that integrates ARES 3.0 with existing access control systems in order to lower operational costs and improve security at controlled access points.
- **Pricing and support:** SaaS model with 1-, 3-, and 5-year plans and flexible pricing. Customers are assigned a project manager and project support team to provide technical assistance as needed. PlateSmart provides online or in-person, hands-on customer training along with written materials and documentation. Official office hours are Monday through Friday 8:00 am–5:00 pm, but the support team is always monitoring incoming tickets and can schedule availability as time is needed (nighttime calibrations, time differences, etc.). PlateSmart also offers higher levels of technical support services, as well as ongoing training and remote support for additional costs.

3.14 Rekor Systems Inc., Scout

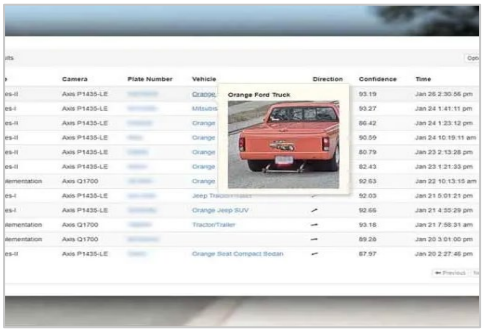

Figure 3-14 Rekor Scout database search screen, Rekor EdgePro and Rekor Edge Max (top to bottom)

Image Credit: Rekor Systems Inc.

Image Processing Data Outputs	License plate numbers (full and partial), vehicle make, model, color, direction of travel, special plates, and the issuing state in the U.S., Canada, and Mexico [31].
Capture Rate	Edge Pro Camera: 99% Edge Max Camera: Not provided
Read Rate	Edge Pro Camera: 98% Edge Max Camera: 99%
Hotlist Info	Supports manual creation of hot lists, as well as import of state, NCIC, shared, and CSV lists. Lists include license plate numbers, vehicle make and model, last seen location, and reasons for inclusion.
How to Access Software	Web-based application accessible from any device with an internet connection. No dedicated desktop or mobile applications.
Data Storage and Middleware	Data stored according to user-defined policies, either on user servers, user cloud, or Rekor's CJIS-compliant cloud via Amazon AWS GovCloud. Supports nationwide data sharing with participating agencies.
Notifications and Searches	Real-time alerts are generated when a listed plate match is detected. Notifications can be configured to be sent via the web desktop interface, email, text, or webhooks to any URL, designated individuals, or groups.
Third Party Interoperability	Supports importing and exporting data from and to other software systems. Scout also supports one-click sharing with Axon's Evidence.com, a cloud-based digital evidence management system [31].
Compatible Hardware	Any IP-based camera that can capture USA plates wider than 75 pixels, and Rekor's Edge Max and Edge Pro cameras (see Appendix B) can perform ALPR processing on-camera.
Cybersecurity	Rekor's systems feature a multi-layered cybersecurity framework with Network Detection & Response (NDR), Endpoint Detection & Response (EDR), and Intrusion Prevention and Detection Systems (IPS/IDS). These systems provide continuous monitoring, real-time analytics, and automated incident response. Rekor also uses SSL, HTTPS, and AWS Cloud Services for security and compliance.

- **Software components and functions**: Rekor Scout consists of several components, including the Scout Agent and the Scout Web Server. The Scout Agent processes data from connected cameras, while the Scout Web Server displays the results on a web-based interface. The software can accept feeds from any IP-based camera that can capture USA plates wider than 75 pixels. Rekor's Edge Max and Edge Pro cameras can perform ALPR processing on-camera. Plate captures include several seconds of recorded video content [31].
- **Pricing and support**: The Edge Pro camera MSRP is $1099 and includes a 1-year warranty. No pricing information was available for the Edge Max.

  Rekor Scout offers multiple SaaS-based pricing plans, named "Basic," "Pro," and "Enterprise."
  - Basic: $10 per month per camera
  - Pro: $65 per month per camera
  - Enterprise: custom pricing

  Support, including warranty support, is available from 8 AM to 5 PM EST, Monday through Friday.

3.15 Safe Fleet, Focus H2 with ALPR

Figure 3-15 Safe Fleet Focus H2 with ALPR
Image Credit: Safe Fleet

Image Processing Data Outputs	License plate numbers, vehicle make and model, special plate details, images of vehicles and license plates, state of origin, and stacked characters.
Capture Rate	>98%
Read Rate	>98%
Hotlist Info	Supports imported NCIC and other regional or local hot lists. The in-car application also supports manually created hot lists which reside locally on the officer's device and do not upload to the central application or other vehicles' ALPR units.
How to Access Software	The software can be accessed through the in-car mobile application, which interfaces with the back-end application running in the cloud.
Data Storage and Middleware	Data recorded to black box on camera in case of connectivity loss.
Notifications and Searches	Real-time notifications of license plate, vehicle, or person-of-interest matches through visual and audible alerts delivered through the software app.
Third Party Interoperability	The system links to hot lists on the agency server for real-time vehicle and license plate comparisons. Specific details about importing or exporting data from/to other software are not provided.
Compatible Hardware	Focus H2 with ALPR (See Appendix B).
Cybersecurity	Integrated security and encryption on cameras. The ALPR back-end system runs completely in the cloud, providing data security and protection from theft, leakage, and deletion. The cloud-based system ensures secure storage and management of operational data.

- **Software components and functions**: The system requires the Focus H2 in-car video recording component, an ALPR module, and Safe Fleet's back-end application for hotlist management. The in-car video component records video evidence, while the ALPR module interfaces with hot lists to compare license plate data in real-time. The back-end application manages hot lists and provides real-time vehicle and license plate comparisons.
- **Pricing and support**: Pricing and support details were not provided. For more information, contact Safe Fleet at 1-877-630-7366 or visit safefleet.net.

3.16 Utility, Pulsar, Rocket

Figure 3-16 Rocket by Utility
Image Credit: Utility

Image Processing Data Outputs	License plate number, issuing state, vehicle make, model, color, vehicle type, date/time, and GPS location data.
Capture Rate	Not provided
Read Rate	Not provided
Hotlist Info	Manual creation of hot lists through Utility's Polaris back-end software. Also supports state and national hot lists.
How to Access Software	Accessed via web-based platforms and mobile devices like MDTs and tablets.
Data Storage and Middleware	Data stored securely within the Polaris cloud-based system. Retention policies are configurable with data retention possible from 30 to 365 days.
Notifications and Searches	Users are notified of matches with hot lists, system alerts, and other critical information via various methods, including email and in-app alerts. Notifications can also be sent to specific users or groups.
Third Party Interoperability	Polaris software supports sharing ALPR data with outside agencies according to individual departmental policies.
Compatible Hardware	Compatible with Utility's Rocket Front, Rocket Rear, and Milesight cameras (See Appendix B). Rocket cameras are compatible with mobile applications but require Rocket XLE in-vehicle cellular modem for connectivity. Also compatible with third party external vehicle mounted cameras manufactured by ACTi.
Cybersecurity	IP address filtering, HTTPS encryption, and password protected user levels.

- **Software components and functions:**
  - Pulsar by Utility: The Pulsar application is AI software tailored for fixed camera installations and portable solar trailers using the Milesight camera. The software supports real-time monitoring and historical data analysis, making it suitable for both live surveillance and post-event investigation. Pulsar AI also integrates with Rocket by Utility to provide ALPR functionality to vehicle-mounted Utility cameras.
  - Rocket by Utility: The Rocket application is designed for Utility's in-vehicle camera systems and externally mounted vehicle cameras. It can interface with the Pulsar AI system to extract ALPR data from images from the Rocket Front and Rear cameras as well as ACTi external vehicle cameras. The software includes features for real-time alerts and notifications, ensuring that officers are immediately informed of any matches with hot lists or other criteria. Rocket also supports integration with video evidence collection, vehicle diagnostics, and environmental sensors for situational awareness.
  - Polaris by Utility: Polaris is optional digital evidence management back-end software that can tie together data from both Pulsar and Rocket systems. It provides a centralized platform for storing, managing, and analyzing all captured data from the fixed and vehicle-mounted systems. Polaris supports advanced search and filtering capabilities to retrieve specific records. It also facilitates data sharing and collaboration among different departments and agencies.
- **Pricing and Support:** Contact Utility for specific pricing; the company offers various pricing plans and support options to meet the needs of different users. Support includes technical assistance, software updates, and training resources. Utility states that SaaS will be at 99% uptime/availability or greater for 24 hours per day, seven days per week, and 365 days per year. Rocket in-vehicle systems and peripherals are warrantied for the duration of the initial agreement and will be repaired or replaced at Utility's cost with an appropriate "Request to Merchant" authorization.

4.0 MANUFACTURER AND VENDOR CONTACT INFORMATION

Additional information on the ALPR Systems included in this report can be obtained from the manufacturers listed in table 4-1.

Table 4-1 Manufacturer Contact Information

Manufacturer	Website	Address	Phone Number	Email Address/Web Form
3dEYE Inc.	www.3deye.me	18 King Street East, Suite 1400, Toronto, ON, M5C1C4, Canada	(416) 822-4052	www.3deye.me/contact-sales
Axon Enterprise, Inc.	www.axon.com	17800 N. 85th Street Scottsdale, AZ 85255	(585) 905-4684	customerservice@axon.com
Flock Safety	www.flocksafety.com	1170 Howell Mill Road NW, Ste 210, Atlanta, GA 30318	(866) 901-1781	www.flocksafety.com/contact
Genetec	www.genetec.com/products/unified-security/autovu	2280 Bd Alfred Nobel, Saint-Laurent, QC H4S 2A4, Canada	(866) 684-8006	www.genetec.com/contact-us
Insight LPR LLC	insightlpr.com	1014 Highway 471, Brandon, MS 39042	(817) 637-0791	support-re@insightlpr.com
iOmniscient Corporation	iomni.ai	854 Mariners Pt Drive, St Louis, MO 63141	(646) 583-3222	sales@iomni.ai
Jenoptik Smart Mobility Solutions	www.jenoptik.us	16490 Innovation Drive, Jupiter, FL 33478	(561) 401-2722	www.jenoptik.com/contact
Leonardo US Cyber & Security Solutions, LLC	www.leonardocompany-us.com/lpr	4221 Tudor Lane, Greensboro, NC 27410	(703) 217-3726	www.leonardocompany-us.com/lpr/contact-us
Motorola Solutions	motorolasolutions.com/lpr	500 W Monroe Street, Suite 4400, Chicago, IL 60661	(800) 367-2346	www.motorolasolutions.com/en_us/contact-us.html

Manufacturer	Website	Address	Phone Number	Email Address/Web Form
NeuroCar	neurocar.pl	Zyczliwa 8, 53-030 Wroclaw, Poland	+48 515 149977	neurocar.pl/company/contact
ParkPow, Inc.	platerecognizer.com	1017 Phoenix Court, Milpitas, CA 95035	(408) 210-9495	platerecognizer.com/contact
PLATELOGIQ	www.vipr.ai	600 Eagleview Boulevard, Suite 300, Exton, PA 19341	(610) 463-0100	www.vipr.ai/#contact
PlateSmart Technologies	www.platesmart.com	640 Brooker Creek Boulevard, Suite 465, Oldsmar, FL 34677	(813) 749-0892	info@PlateSmart.com
Rekor Systems Inc.	www.openalpr.com/software/scout	6721 Columbia Gateway Drive, Suite 400, Columbia, MD 21046	(410) 762-0800	www.openalpr.com/contact
SafeFleet	www.safefleet.net	6800 East 163rd Street, Belton, MO 64012	(844) 258-8178	www.safefleet.net/contact-us
Utility	www.utility.com	250 E Ponce De Leon Avenue, Decatur, GA 30030	(800) 597-4707	www.utility.com/contact

5.0 CONCLUSIONS

ALPR systems are essential tools for law enforcement agencies, aiding in the identification and tracking of vehicles involved in criminal activities. The current market for commercial off-the-shelf law enforcement ALPR systems in the United States includes a wide range of products and capabilities. These systems vary significantly in terms of hardware and software features, from dedicated ALPR cameras with sophisticated edge image-processing software to mobile applications that can be deployed on smartphones. Many vendors of patrol car video systems are also integrating ALPR into their units as an add-on capability. Some ALPR vendors are also offering access to data collected from their systems across the country.

The 16 products included in this report offer either a completely integrated ALPR system or an ALPR software-based system that can be integrated with new or existing ALPR hardware. These COTS systems are all CJIS- and NDAA Section 889-compliant.

The ALPRs in this report include features such as the ability to detect vehicle make, model, and color; the ability to manually create hot lists or import via CSV files; and the ability to ingest state and federal hot lists. Some offer customizable delivery of alerts, multi-factor authentication to prevent unauthorized access to data, and compatibility with third-party cameras. The prices for these products vary significantly depending on the size and scope of the ALPR project, the type of installation (cloud-based or on-premises), and the purchase type (e.g., subscription, licensing, purchase).

In addition to the technological capabilities, agencies must consider operational factors such as ease of integration with existing systems, data storage and management, cost, and the ability to generate actionable intelligence from the collected data. The use of ALPR systems also raises important considerations regarding privacy and data security, which must be addressed through robust policies and compliance with regulatory standards. Among these, ensuring that the systems meet CJIS standards is essential to protect sensitive information and maintain public trust. Emergency responder agencies should carefully research the overall capabilities and limitations of ALPR systems in relation to their agency's operational needs when making equipment selections.

Overall, the ALPR market is evolving rapidly, with continuous advancements in technology and increasing adoption by law enforcement agencies across the country. Agencies must stay informed about the latest developments and carefully evaluate their options to ensure they select the most suitable systems for their specific needs.

Appendix A. INGRESS PROTECTION LEVELS (IP CODE)

This section provides information on the levels of ingress protection as specified by the 2-digit designations in the IEC 60529 standard [25]. Table A-1 provides levels of solid ingress protection (first digit). Table A-2 provides levels of liquid ingress protection (second digit).

Appendix Table A-1 Levels of Solid Ingress Protection per First Digit of IP Code

Digit	Object Size Effective Against	General Description
0	No Protection	No protection against contact and ingress of solids
1	> 50 mm	Large surfaces, e.g., back of hand, but no protection against deliberate contact with body part
2	> 12.5 mm	Prevents entry of fingers and similarly sized objects
3	> 2.5 mm	Prevents entry of tools, thick wires, etc.
4	> 1 mm	Prevents entry of most wires, screws, large ants, etc.
5	Dust Protected	Dust ingress not entirely prevented but does not enter in sufficient quantity to interfere with satisfactory operation of equipment
6	Dust Tight	No ingress of dust

Appendix Table A-2 Levels of Liquid Ingress Protection per Second Digit of IP Code

Digit	Water Exposure Protection	General Description
0	No Protection	No protection
1	Vertically dripping water	Vertically dripping water has no harmful effects
2	Dripping water, enclosure tilted up to 15 degrees	Vertically dripping water has no harmful effects when enclosure is tilted at an angle up to 15 degrees of normal vertical position
3	Spraying water	Water sprayed at angles up to sixty degrees from the vertical position has no harmful effects
4	Splashing water	Water splashed against the enclosure from any direction has no harmful effect
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction has no harmful effects

Digit	Water Exposure Protection	General Description
6	Powerful water jets	Water projected in powerful jets against the enclosure from any direction has no harmful effects
7	Temporary immersion in water	Ingress of water in harmful quantity is not possible when the enclosure is temporarily immersed in water under standard conditions of pressure and time
8	Continuous immersion in water	The equipment is suitable for continuous immersion in water under conditions more severe than for numeral 7

Appendix B. HARDWARE SPECIFICATIONS FOR COMPATIBLE CAMERAS

This appendix provides information on cameras compatible with the ALPR products in this report. The cameras, listed alphabetically by compatible ALPR system, and their specifications are shown in Table B-1. This information has not been independently verified by the SAVER program.

Below are definitions of the product information in Table B-1, listed in column order.

ALPR System: indicates the corresponding ALPR system (described in section 3) compatible with the camera

Capture Type: gives whether images are recorded as photos (still) or video; additional information describing the camera is in parentheses.

Deployment: lists available options for fixed (F), portable (P), or vehicle (V) camera mounting.

Range: states the optimal capture distance of the camera (in feet).

FOV: states field of view of the camera as reported by the vendor. Values shown in degrees refer to horizontal FOV unless otherwise stated. Where both horizontal and vertical degrees are reported, "H" denotes horizontal and "V" denotes vertical.

Camera Specifications: indicates the resolution of color and black and white (B&W) images in pixels or megapixels (MP), progressive scan (p), frames per second (fps), and if the camera has a global shutter (see Section 2.1).

IR Illuminator: notes the type (in wavelength of IR light) or effective range of infrared illumination (in feet), if included.

Dimensions and Weight: lists the external dimensions of the camera in inches followed by the physical weight of the camera in pounds (lb).

Environment: includes the operating temperature range in degrees Fahrenheit (° F) and the ingress protection (IP) rating against solids and liquids.

Power: indicates the power sources available for the camera.

Connectivity: names how the camera transmits data to other components of the ALPR system.

EMC: indicates whether the camera complies - yes (Y), no (N) or information not provided (NP) – with FCC Part 15, Subpart B for electromagnetic compatibility measures intended to prevent the camera from causing electromagnetic interference (EMI) to other devices, being susceptible to EMI from other devices, or being susceptible to EMI from itself.

Appendix Table B-1 APR Hardware

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Axon Fleet 3	Axon Fleet 3 Vehicle Camera	Video	V	Up to 50	60°	Color: 4k	None	NP	-40–185° NP	POE	Mobile router	Y
Flock OS	Flock Falcon LR	Photo (Long Range)	F	Up to 250	Up to 50 ft	NP	Pulsed LED 850 nm	3.3 x 4.3 x 10.5” NP	NP NP	Swappable battery, solar and AC/DC charging	Cellular	NP
Flock OS	Flock Falcon SR	Photo (Short Range)	F	NP	NP	NP	Pulsed LED 850 nm	NP	NP NP	Swappable battery, solar and AC/DC charging	Cellular	NP
Flock OS	Flock Falcon Flex	Photo (Motion Activated)	P	Up to 100	2 lanes	NP	Pulsed LED 850 nm	8.75 x 3 x 3” 3 lb	NP IP 65	14 Ah recharge-able internal battery	Cellular	NP
Genetec AutoVu	Genetec Sharp V	Video	F	9–148	NP	Color/B&W: 1920 x 1200p @ 30 fps	Pulsed LED (940 nm, 850 nm, 740 nm, and 590 nm)	2.5 x 7.6 x 8.5” 5.1 lb (wired) 6.6 lb (wireless	–40–149° IP 66	POE or 24 VDC	Wired, Wi-Fi, Cellular options	Y

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Genetec AutoVu	Genetec Sharp Z3	Photo and Video (3 color camera sensors, 1 B&W sensor)	V	Up to 63	NP	Color/B&W: 1456 x 1088p,, 30 fps	Pulsed LED (940 nm, 850 nm, 740 nm, and 590 nm)	1.7 x 5.1 x 3.6” 1.2 lb	–40–131° IP 66	POE or 24 VDC	Wired to base unit	Y
Genetec AutoVu	Genetec Cloudrunner CR-H2	Photo	P	9–125	50°	Color: 2 MP	NP	12.5 x 10 x 6” NP	NP NP	Lithium battery with 70 W solar panel	Cellular 4G LTE	NP
Insight LPR MX Guardian	Insight Matrix Edge	Photo	F	10–130	2 lanes	Color/B&W: 1440 x 1080p, @ 226 fps, global shutter	810 nm or 740 nm.	7.1 x 6.8 x 2.1” 4.2 lb	–22–149° IP 68	Ethernet-POE+, 12 Volts DC Input/ Solar option	Wired, Wi-Fi, Cellular	N
Insight LPR MX Guardian	Insight MX Defender	Photo	F	Up to 50	12–75°	Color/B&W: 1600 x 1302p, @ 36 fps, global shutter	810 nm or 740 nm.	5.5 x 6.6 x 2.1” 4 lb	–22–158° IP 68	Ethernet-POE+, 12 Volts DC Input/ Solar option	Wired, Wi-Fi, Cellular	N

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Insight LPR MX Guardian	Insight MX Defender S	Photo	P	NP	NP	NP	NP	5.5 x 6.6 x 2.1” NP	–22–158° IP 68	50 W solar panel, Ethernet-PoE+, 12 Volts DC Input	Cellular	N
iOmniscient	Analytics Ready Camera LF005	Video	F	Up to 230	99”	Color/B&W: 1920 x 1080p	Up to 150 ft	7.9 x 4.5 x 5.12” 1.8 lb	14–14 ° F IP 66	PoE or 12 VDC	Wired to edge server, with Wi-Fi or cellular	N
iOmniscient	Analytics Ready Camera LF006	Video	F	Up to 230	99”	Color/B&W: 1920 x 1080p	Up to 150 ft	11.4 x 3.7 x 3.2” 1.8 lb	14–140° F IP 66	PoE or 12 VDC	Wired to edge server, with Wi-Fi or cellular	N
iOmniscient	Analytics Ready Camera LF013	Video	F	Up to 394	165”	Color/B&W: 1920 x 1080p	Up to 180 ft	7.2 x 7.2 x 11.23” 1.9 lb	14–140° F IP 66	PoE or 12 VDC	Wired to edge server, with Wi-Fi or cellular	N
iOmniscient	Analytics Ready Camera LF101	Video	V	Up to 165	Up to 65”	Color/B&W: 1920 x 1080p	Up to 55 ft	6.8 x 2.1 x 5.41” 2 lb	14–140° F IP 66	PoE or 12 VDC	Wired to edge server, with Wi-Fi or cellular	N

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Jenoptik	VECTOR	Photo	F, P, V	Up to 82	3 lanes	Color/B&W: 5 MP, @ 30 fps	15 integrated IR LEDs (850 nm)	4.9 x 6.6 x 7.6” 6.4 lb	–40–140° F IP 67	Internal 48 VDC battery, Solar capable	Wired, Wi-Fi, Cellular, Bluetooth	N
Leonardo ELSAG	Mobile Plate Hunter	Photo	V	12–65	14 x 10” to 19 x 14”	Color/B&W: 1440 x 1080p, 60 fps	LED 740nm and 870nm	4.6 x 3.5 x 1.6” 1.8 lb	–40–140° F IP 67	12 VDC	Wi-Fi, Cellular, Blue-tooth	N
Leonardo ELSAG	F4 Fixed	Photo	F	25–150	16 x 12” to 22 x 17”	Color/B&W: 1920 x 1200p, 60 fps	LED 740 nm, 850 nm, 940 nm	6.5 x 5 x 7” 8.7 lb	–22–149° F IP 67	48 VDC PoE	Wired, Wi-Fi, Cellular	N
Leonardo ELSAG	Street Sentry Solar	Photo	P	25–75	12 x 24”	Color/B&W: 1440 x 1080p, global shutter	740 nm or 870 nm	4 x 6 x 4” 4.2 lb	–40–140° F IP 67	12 VDC battery box and solar panel	Wired, Wi-Fi, Cellular	N
Leonardo ELSAG	VPH 350	Photo	F	12–75	16” (2.3°) H 9.6” (1.3°) V	Color/B&W: 920 x 1080p, up to 60 fps	870 nm	5.8 x 5.8 x 17.3” 5.3 lb	–40–140° F IP 66	PoE	Wired, Wi-Fi, Cellular	N

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Motorola Vigilant	L5F Fixed	Video	F	14–115	NP	Color/B&W: 1440 x 1080p, global shutter	Pulsed LED, 850 nm, 750 nm	6.9 x 6.5 x 2” 3.5 lb	–40–140° F IP 68	PoE	Wired	NP
Motorola Vigilant	L5M Mobile	Video	V	9–70	NP	Color/B&W: 1440 x 1080p, global shutter	Pulsed LED 850 nm	6.9 x 4.5 x 2” 3.5 lb	–40–140° F IP 68	PoE	Wired	N
Motorola Vigilant	L6Q Quick Deploy	NP	P	Up to 55	24”	Color: 1920 x 1080p	Pulsed LED 850 nm	5.0 x 2.4 x 7.1” NP	–22–131° F IP 67	Swappable internal battery, Optional solar, Optional direct line	Blue-tooth, Wi-Fi, Cellular	N
Platelogiq VIPR	PlateLogiq VIPR Fixed	Video	F	Up to 100	60”	Color/B&W: 1920 x 1080p, @ 30 fps, global shutter	850 nm	11 x 6 x 4” 1.25 lb	–40–140° F IP 67	PoE	Wired, Wi-Fi, Cellular	N
Platelogiq VIPR	Platelogiq VIPR Fixed Long Range	Video	F	Up to 300	65”	Color/B&W: 1920 x 1080p, @ 30 fps, global shutter	850 nm	14 x 5 x 6” 4.5 lb	–40–140° F IP 67	PoE	Wired, Wi-Fi, Cellular	N

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Platelogiq VIPR	Platelogiq VIPR Mobile	Video	V	Up to 45	25”	Color/B&W: 1920 x 1080p, @ 30 fps, global shutter	850 nm	3 x 3 x 3” 0.5 lb	–40–140° F IP 67	PoE	Wired	N
Rekor Scout	Rekor Edge Pro	Video	F	Up to 75	7.1–55.2°	Color: 1080p	Yes	4.3 x 3.5 x 8.8” 11 lb	–4–122° F IP 67	PoE, Optional 12 VDC; Optional solar	Wired	NP
Rekor Scout	Rekor Edge Max	Video	F	Up to 300	3–6 lanes	Color: 1080p	Yes	NP	–22–131° F IP 65	PoE, Optional solar	Wired, Cellular	NP
SafeFleet	Focus H2 with ALPR	Video	V	NP	56–120° H 30–64° V	Color: 1080p 720p 480p	Rear Camera IR LEDs and Auto IR	NP	–4–158° F NP	12 VDC	Blue-tooth, Wi-Fi, and Cellular	Y
Utility	Utility Rocket Front	NP	V	NP	87.5° H 47.6° V	Color/B&W: Up to 1080p	Two IR 850 nm	4.7 x 2.3 x 1.9” 0.76 lb	–4–140° F IP 67	PoE	Cellular	Y

ALPR System	Camera Vendor and Model	Capture Type	Deployment	Range (ft)	FOV	Camera Specifications	IR Illuminator	Dimensions (in) and Weight (lb)	Environment (temp range (° F) and IP)	Power	Connectivity	EMC
Utility	Utility Rocket Rear	NP	V	NP	87.5° H 47.6° V	Color/B&W: Up to 1080p	850 nm	4.7 x 2.3 x 1.9” 0.76 lb	–4–140° F IP 67	PoE	Cellular	Y
Utility	ACTi External	NP	V	Up to 45	26”	Color: 1920 x 1080p	850 nm	4.7 x 2.3 x 1.9” 0.76 lb	NP IP 67	PoE	Cellular	NP
Utility	Utility Milesight Camera	NP	F, P	32–82	26”	Color: 1920 x 1080p	850 nm	4.7 x 2.3 x 1.9” 0.76 lb	NP IP 67	6.4 Ah Battery with 45 W solar panel	Cellular	NP

F/P/V Indicates fixed, portable, or vehicle camera mounting

NP Indicates no information was provided

Y/N Indicates the systems has the feature (Y for “yes”) or does not (N for “no”)

H/V Indicates “horizontal (H) and vertical (V) if both degrees of field of vision were provided; where only one FOV value is given, it is the horizontal value.

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