

# HOW ENHANCED VIDEO SURVEILLANCE BOOSTS MANUFACTURING

**From security to efficiency**, smart camera systems and analytics deliver a variety of advantages in factory settings.

## EXECUTIVE SUMMARY

Enhanced video surveillance technologies promise to revolutionize the efficiency and effectiveness of manufacturing environments. These solutions combine cutting-edge video cameras, storage and management hardware with modern machine learning and analytics technology to provide organizations with hindsight, insight and foresight into their operations. The addition of video analytics provides the ability to automatically analyze, detect and trigger alerts on events seen by cameras in real time.

Manufacturers are increasingly turning to the Internet of Things (IoT) to provide the steady flow of data required to make crucial business decisions in real time. Enhanced video surveillance technology adds another important data source to these monitoring systems, allowing organizations to supplement traditional physical security measures as well as achieve goals previously unachievable through video surveillance. These include preventive worker safety alerts and the improvement of operational processes, allowing plant managers to proactively intervene.

Enhanced video surveillance provides manufacturers with the ability to actively monitor their factory floor and quickly act upon that information to improve the bottom line.

## The Emergence of Enhanced Video Surveillance

Ten years ago, the world of video surveillance was simple and straightforward. Manufacturers installed video surveillance cameras as both a deterrent and reactive control. The mere presence of cameras made malicious individuals think twice before victimizing a potential target. The data gathered by those cameras served as a forensics resource in the event of a security incident. The technology involved was simple: Cameras provided video feeds that went to two different targets — a bank of video displays monitored in real time by human security personnel; and storage media, such as videotapes or DVDs, where the footage was archived.

Technology advances since that time have revolutionized the field of video surveillance. Manufacturers no longer need to depend on humans to provide real-time monitoring of cameras and have a tremendous set of analytic resources available to automate the processing of video images. The technology developed during the age of machine learning and artificial intelligence can be applied directly to video surveillance applications. Modern solutions can analyze and interpret video feeds in real time, providing operational awareness of the manufacturing floor and the state of physical facilities.

Video surveillance hardware has also matured significantly. Firms no longer depend on closed-circuit cameras that provide analog video feeds to analog recorders for later playback. Modern video surveillance embraces digital technology. Cameras now connect to storage and analytic systems using a company's existing IP network, over both wired and wireless connections. This greatly expands the range of video surveillance solutions in the organization and reduces the cost of new deployments by allowing cameras to be positioned at any location where network connectivity is available.

The manufacturing industry is going through its own digital transformation effort at the same time as this radical change within the video surveillance field. The Industry 4.0 trend now has manufacturers turning to connected devices to gather data from a wide variety of industrial processes. The emergence of IoT allows managers to fine-tune operations to improve efficiency and increase the uptime of production lines. The data generated by IoT sensors may also be integrated with data from other systems to create a single digital flow that enables manufacturers to digitize all of their operational processes.

Video surveillance cameras and systems play an important role in these digital transformation efforts. Cameras are no longer simply devices that capture moving images for storage and later playback. While they certainly retain this ability, they are now real-time video sensors, creating data streams that may be fed directly into an organization's digital workflows. In fact, many cameras now come equipped with audio, temperature, humidity and other sensors built in that provide additional data points for analysis.

## Enhanced Video Surveillance Benefits

Enhanced video surveillance systems implement next-generation video content analysis technology, allowing organizations to become far more strategic about their uses

of video than in the past. Through the use of video analytics, enhanced video surveillance systems detect and classify objects and events in real time, building a structured database of information from the raw video. This enables three key operational advantages: hindsight, insight and foresight.

**Hindsight** is the most common reason for deploying video surveillance systems. Organizations might need to know what happened at a physical location in the past, and video surveillance systems meet that demand. With legacy systems, users had to manually review recordings to look for events of interest, fast-forwarding through hours of video to find the targeted activity. Enhanced video surveillance systems allow analysts to write queries that define the activity of interest, such as a door opening, the presence of a person in a restricted area or other factors such as clothing color or gender. This shrinks forensics time by allowing the system to quickly identify potential items

of interest. Surveillance tasks that would have required hours of manual review with a legacy system may now be accomplished in a matter of minutes using a simple keyword search.

**Insight** extends the use of video surveillance to real-time applications without necessarily requiring a human

being to constantly watch a bank of video monitors. Enhanced video provides organizations with immediate automated analysis of what is actually happening on a manufacturing floor. This real-time insight can deliver important information to decision-makers when it's needed most. For example, insight from enhanced video systems can alert plant managers to an incident or accident as it unfolds on the factory floor, facilitating rapid intervention.

**Foresight** is the most innovative emerging application of enhanced video. Organizations may leverage tools such as the Cisco Kinetic IoT platform to apply predictive analytics to data gathered from video feeds. These tools then deliver important forecasts to decision-makers. For example, enhanced video foresight can predict when critical equipment will require proactive maintenance based on analysis of thermal imaging data, allowing the company to handle it as scheduled downtime instead of incurring an unplanned outage, idling the production line or plant. This approach is much more efficient and far less costly than recovering from an unexpected shutdown.

**130 million**

Number of video surveillance cameras shipped in 2018<sup>1</sup>

## Use Cases for Enhanced Video Surveillance

The use cases for enhanced video surveillance technology within a manufacturing environment are diverse, and are limited only by the deployment of sensors and the imagination of IT and operational leaders. Common use cases involve traditional physical security applications, worker safety and operational management. For example, manufacturing firms might deploy the automated analytical technology of enhanced video systems to:

- Detect motion in a restricted area, such as entry to a server closet or movement near high-voltage equipment or hazardous materials
- Monitor the movement of valuable assets, such as molds and dies

- Identify line-crossing events, such as a worker reaching into an unsafe zone
- Distinguish unknown faces on a factory floor from employees and partners identified through facial recognition technology
- Read license plates to identify the vehicles entering and leaving a facility
- Detect and count the number of people or vehicles in an area
- Inspect raw materials and finished goods

The beauty of enhanced video surveillance systems is that they empower organizations to achieve two or more of these use cases with a single infrastructure investment. The same technology that provides traditional physical security can also monitor worker safety and measure operational efficiency. These multiple applications improve the cost-effectiveness of capital expenditures and increase the organization's return on investment.

### The Technological Foundations of Enhanced Video Surveillance

Enhanced video surveillance brings modern technology and artificial intelligence techniques to bear on the challenge of monitoring factory floors and other facilities. This greatly expands upon the functionality of traditional video monitoring systems and, therefore, requires an ecosystem of hardware and software that supports these capabilities. Organizations considering the deployment of an enhanced video surveillance solution should plan the deployment carefully and consider five major components of the deployment: video cameras, a video management system, storage, networking and video analytics.

### Video Cameras

Modern video surveillance cameras offer a wide range of advanced features compared with the cameras of a decade ago. Of course,

these cameras still provide a video feed that captures moving images of the monitored environment, and they do so with far higher quality and clarity than their legacy analog counterparts. The image quality provided by relatively inexpensive video cameras meets or exceeds that of HDTVs.

Today's cameras go far beyond providing high-quality images, however. Modern video cameras can monitor activity that would be otherwise invisible to a human guard by leveraging night vision capabilities and infrared heat detection. Most cameras also include basic analytic features, such as line-cross detection and people counting, although more sophisticated versions of these features are generally found in the analytic components of enhanced video surveillance systems.

Manufacturers deploying video cameras should consider the available features in light of their organizational needs, operating environment and surveillance use cases. A third-party consultant can help sort out the features and capabilities that best meet the manufacturer's needs while remaining within financial constraints.

### Video Management System

If video cameras represent the eyes and ears of an enhanced video surveillance solution, the video management system is the brain, serving as the central point of orchestration, management and analysis for the deployment. The choice of a video management system is perhaps the most crucial decision that an organization makes, as it will determine the functionality of the system for years to come.

The most important criteria to consider when evaluating management systems is the ability to perform the core features of video surveillance in an efficient, effective and intuitive manner. The system must possess core capabilities, which include:

- Managing cameras deployed throughout the enterprise (including remote locations, if applicable)
- Receiving and processing video feeds from those cameras

## IoT and Manufacturing

Enhanced video surveillance is just one component of the broader Internet of Things — a technology trend toward connecting a broad range of devices to the internet to gather data about the world around us. IoT applications vary widely, from smart thermostats and connected automobiles to autonomous industrial equipment on a factory floor.

Manufacturers, in particular, see tremendous potential in IoT deployments because of the complexity of managing the range of equipment on a factory floor. Newer industrial tools typically are digitally enabled, with IoT built in by the vendor. However, deploying IoT does not necessarily require a significant investment in the production line.

Many manufacturers first retrofit their existing equipment with sensors and controllers that add IoT capabilities.



Once a firm adds IoT technology to its production line, it typically begins to experience significant improvements in the efficiency and effectiveness of manufacturing operations. Sensors can count products at various stages of manufacturing to quickly pinpoint production bottlenecks, identify overheating equipment before a failure occurs and spot the presence of workers before beginning potentially dangerous operations. Production line supervisors may view IoT deployments as their eyes, ears and hands across the entire factory floor, monitoring efficiency and even automatically intervening to resolve common issues.

- Managing video storage and lifecycle requirements
- Displaying video for playback
- Compatibility with specialized video analytics applications
- Connecting with other systems for integration with access control or alert and notification systems

While analyzing current features is vitally important, manufacturers should also pay attention to the company's future software development plans. As a vendor deploys new software features, customers benefit from those enhancements through updates, making an analysis of the vendor's future development roadmap a crucial component of evaluating management system options.

## Storage

Storage is, of course, a core requirement for an enhanced video surveillance solution, and manufacturers should carefully consider the storage requirements of these systems when building out video deployments. While the organization may already have an existing storage infrastructure supporting a variety of IT systems, it may not be optimal for use with a surveillance system.

Storage solutions designed specifically for video management can support extremely high volumes of concurrent input and output operations. The video surveillance system will continuously receive live video streams from dozens, hundreds or even thousands of cameras simultaneously and will need to write those feeds to storage at the same time as users are retrieving video for playback, with minimal latency. Some storage vendors are now producing appliances that are specifically designed to support video surveillance use cases.

## Network

Video surveillance solutions also place a significant burden on the network, which must carry live video streams back to the management system and support user access to stored video. These operations are bandwidth-intensive, creating requirements that often exceed the designed capacity of manufacturing networks.

Video solutions may also have specific network functionality requirements that don't exist in other manufacturing use cases. For example, modern IP-connected video cameras are designed to draw electrical power from the network, using a technology called Power over Ethernet (PoE). Older network switches may not support this technology, potentially requiring an edge upgrade.

Manufacturers deploying enhanced video surveillance should begin by conducting a network assessment designed to evaluate their network's readiness for the system. They may discover that a network upgrade is a prerequisite for deploying digital video surveillance.

## Video Analytics

Analytics are where enhanced video surveillance systems shine. They provide the artificial intelligence and machine learning that catapult modern digital surveillance solutions far beyond the capabilities of their analog ancestors. Examples of analytic functionality found in enhanced video surveillance solutions include:

- Motion detection
- Object movement detection
- Line- or boundary-crossing detection
- Facial recognition
- Object or person counting
- Keyword search across multiple cameras
- Case management
- Video synopsis
- Customizable dashboards
- Business system integration

These analytic capabilities may be found across a variety of components. Some features may be built in to cameras and other sensors deployed on the edge. Many may be core features of the organization's video management solution, while specialized functionality may require add-on software. For example, BriefCam offers a comprehensive video analytics solution that

## Cloud-Based Video Surveillance

Many manufacturers consider using cloud computing for portions of their video management strategy. This can include the use of cloud resources for video analytics, cloud storage for both real-time video access and archival purposes, and even cloud-based managed video solutions. As manufacturers consider these options, they should carefully evaluate their organization's readiness for cloud approaches. Manufacturers with extensive experience in cloud solutions may be much more inclined to pursue this route than those that would be making a first foray into cloud computing.

Network capacity is one of the core factors that manufacturers should keep in mind when considering a cloud deployment. Video solutions are far more bandwidth-intensive than many other technology applications. In an on-premises video deployment, manufacturers must ensure that their internal networks are capable of supporting the bandwidth requirements of video surveillance. In a cloud-based deployment, this requirement extends beyond the organization's internal network to its external network connections. Manufacturers must ensure that their internet connection is robust enough to handle existing needs along with video streaming to and from the cloud.



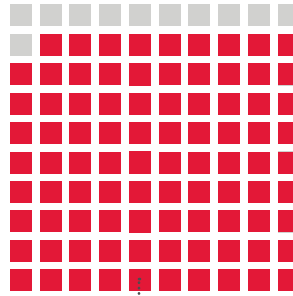
integrates video from diverse sources and provides advanced analytic capabilities that often exceed the base features of even leading video management solutions, such as those from Milestone Systems.

Organizations planning an enhanced video surveillance deployment should carefully think through their current and future analytics use cases at an early stage of the design process. This analysis should include an assessment of the cameras required to meet each use case as well an identification of the solution components that will perform each analytical task. These requirements may influence the selection and placement of other system components.

Enhanced video surveillance not only requires quality cameras, but also a strong supporting ecosystem. As a manufacturer considers the deployment of an EVS solution, it should carefully consider the capabilities required to meet not only current requirements but also future requirements that may not yet exist. The modular nature of video system components makes it possible to scale deployments and add new functionality as business needs change. Most organizations eventually move beyond their initial requirements to embrace additional deployments that assist with digital transformation efforts.

### Effective Deployment of Enhanced Video Surveillance

Deploying an enhanced video surveillance solution requires commitment from across an organization. Video technology touches the IT teams who must install, configure and maintain the software and hardware required by the platform. Operations



98%

Percentage of companies that use some form of digital surveillance<sup>2</sup>

teams must understand and take advantage of the enhanced functionality of advanced video surveillance systems to reap the efficiency benefits. Physical security teams must incorporate these new capabilities into their workflow, while cybersecurity teams must work to secure the systems by mitigating vulnerabilities in camera endpoints and preventing misuse of video content.

Above all, the deployment of an enhanced video surveillance solution requires buy-in from senior managers, who must approve both the financial investment required to purchase system components and the staff resources required to deploy them effectively. As with many other IoT solutions, obtaining this senior-level buy-in can be a challenge. Executives

may be reluctant to invest in new technologies. Managers who champion the deployment of this technology should carefully build their business case and highlight the potential for cost savings, efficiency improvements, safety increases and security benefits.

Integration challenges for video surveillance deployments are largely twofold. First, organizations assembling a video surveillance solution often obtain components from different vendors and must ensure that they work together smoothly. Second, advanced analytics approaches may require integrating the video surveillance platform with other sources of manufacturing and business data. These integrations often require specialized expertise in video technology and, for this reason, many manufacturers choose to involve an experienced third party to assist with optimizing operations and performance.

Production employees should be deeply involved in the planning, design and deployment of a manufacturer's enhanced

### Securing Video Surveillance Systems

Cybersecurity is a critical consideration for enhanced video surveillance systems. Video streams include live views of crucial operational systems and may often capture proprietary information about manufacturing processes, employee identity, inventory, production rates and other valuable business intelligence. If this sensitive information fell into the hands of a competitor, it could have a devastating impact on a business.

Recent events underscore the need to include cybersecurity requirements as both an initial and ongoing process requirement. In September 2018, Tenable announced the discovery of a significant vulnerability in some closed-circuit TV systems that would allow an attacker not only

to compromise an organization's video system but also to use that vulnerability as a foothold from which to exploit other systems on the enterprise network.



For this reason, cybersecurity professionals should be involved in the earliest stages of the enhanced video surveillance solution design. Security team members bring particular expertise to identifying requirements and implementing controls designed to protect the confidentiality, integrity and availability of information assets, including video.

The controls used to secure video solutions are similar to those deployed elsewhere in the enterprise and include endpoint protection, patch management, vulnerability scanning, access control and encryption.

Source: <sup>2</sup>businessresearcher.sagepub.com, "Workplace Surveillance," Nov. 5, 2018

video surveillance equipment. These team members know more about a factory's operations than executives, technologists, project managers and other staff involved in the deployment effort. Their expertise is crucial to designing a solution that is positioned to achieve maximum value, especially if the company hopes to use machine vision to track assets and workflow in production processes.

Finally, video management solutions must also involve operational staff who will handle day-to-day monitoring and support of the solution. The project team should include several stakeholders who will actually operate the system in production

and can provide the important operations perspective that will ensure usability of the final design. This cross-section of operational employees should represent each of the intended use cases for the enhanced video surveillance system. For example, manufacturers seeking to achieve safety improvements through this technology should include safety staff in their planning. Those team members should model real-world safety workflows during the implementation and testing of the solution. The operational team members involved in the design will also play a crucial role in evaluating the effectiveness of the system post-deployment and identifying areas of future improvement.

### CDW: A Manufacturing Partner That Gets IT

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CDW helped to pioneer the deployment of IoT technology in the manufacturing sector, and we understand the nuances of integrating automations with new and legacy manufacturing equipment. Our solution architects will work closely with functional experts from your team to design the next generation of your manufacturing process.

We begin our IoT manufacturing engagements with an IoT Envisioning Workshop, where we work with you to identify the best deployments of IoT technology for your business. We also conduct network assessments to ensure that your facilities have the network infrastructure required to handle an IoT deployment. Our manufacturing customers can choose the services they need from CDW, including consulting engagements, professional services and managed services.

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### The CDW Approach



#### ASSESS

Evaluate business objectives, technology environments, and processes; identify opportunities for improvements and cost savings.



#### DESIGN

Recommend relevant technologies and services, document technical architecture, deployment plans, "measures of success," budgets and timelines.



#### DEPLOY

Assist with product fulfillment, configuration, broad-scale implementation, integration and training.



#### MANAGE

Proactively monitor systems to ensure technology is running as intended and provide support when and how you need it.

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