

Transforming Oil & Gas with Optical Automation

CASE STUDY

HOW INTELLIGENT CAMERAS REDUCE MANUAL INSPECTIONS, DETECT LEAKS FASTER, AND IMPROVE WORKFORCE EFFICIENCY

ANDREW HINZ, VICE PRESIDENT OF SALES, *TWIN EAGLE SOLUTIONS*
JUSTIN MARTIN, DISTRICT SALES MANAGER, *BOSCH SECURITY AND SAFETY*

INTRODUCTION

The oil and gas industry (O&G) has not historically been known for its innovation. However, in light of economic, environmental, and political shifts, many O&G companies are actively exploring ways to be more proactive, operate more efficiently, reduce waste, and simplify compliance. This white paper explores how optical automation, an innovative solution architected by Twin Eagle Solutions, is modernizing the industry, and helping O&G customers achieve those goals. It also briefly discusses relevant applications in other industries.

WHAT IS OPTICAL AUTOMATION?

Optical Automation (OA) is a set of tools and technologies that can be programmed to perform any visual inspection or monitoring functions in remote sites. Artificial intelligence, machine learning, and advanced analytics allow intelligent cameras to not only capture events but to learn patterns, detect inconsistencies or anomalies, and proactively trigger alerts or actions in response to those events.

HIGHLIGHTS

- 24/7 Remote Monitoring
- Detect Unauthorized Personnel
- Monitor Safety Requirements
- Plug and Play Platform
- Decreased Carbon Footprint
- Reduction in Regulatory Penalties and Fines
- Increased Accuracy in Gauge Readings
- Improved Response Times to Alerts
- Predictive Maintenance in Field

Optical Automation is at the forefront of the Industrial Internet of Things (IIoT), utilizing edge technology to link central and remote sites to improve efficiency, productivity, reliability, and safety. Specific real-world applications of Twin Eagle's Optical Automation include Remote Site Inspection (RSI), Fire Watch, Thermal and Radiometric Imaging, and Intelligent Monitoring.

EMPOWERING THE DIGITAL OILFIELD

Twin Eagle Solutions was contacted by a midstream transportation solutions provider who was looking to manage remote operations and inspections at multiple sites more efficiently. Midstream providers are responsible for transportation of oil, and leaks in the pipeline can be very costly in terms of product waste and state and/or federal agency fines associated with leaks.

This midstream provider maintains the highest level of safety protocols for its operations. Corporate policy dictates that every site must be inspected every day. With multiple, far flung sites and limited workforce bandwidth, "every site, every day" became challenging and expensive. Limitations included:

- Long drive times between sites
- Workforce capacity to reach and inspect all sites during the work week
- Unplanned but necessary maintenance of sites further reduced capacity

With only manual processes in place, the company was inspecting ~70% of their sites during the regular work week and 30-40% of their sites on the weekend. This left significant room for error in terms of undetected leaks. In addition to product loss, the company was subject to significant penalties, which are typically calculated from the time of last inspection to the time the leak is repaired. The environmental and financial costs of an undetected leak can be significant.

In O&G, time is, in fact, money, so a new solution was required to achieve the following goals:

- Real-time optical leak detection
- Decreased response and repair times
- Improved regulatory compliance
- Reduced fines and other penalties
- Improved employee efficiency
- 100% site inspection rate

A LEADING EDGE SOLUTION

To solve this problem, Twin Eagle Solutions partnered with Bosch, a leading engineering and electronics company that manufactures the Bosch AUTODOME 7000i - 2MP camera. This camera is commonly used in urban environments to learn and detect scene changes. While Intelligent Video Analytics had not been used previously at an oilfield, the Twin Eagle team believed it had the capability to help identify leaks based on tracking environmental elements and patterns.

The AUTODOME 7000i is equipped with Intelligent Video Analytics (IVA) and Bosch's Camera Trainer, a machine learning capability that allows the camera to learn patterns and detect any changes in those patterns over time. This can detect elements such as graffiti, unusual traffic patterns or events, unauthorized persons in restricted areas, an unattended bag that was previously not present, an authorized vehicle or unknown license plate, and more.

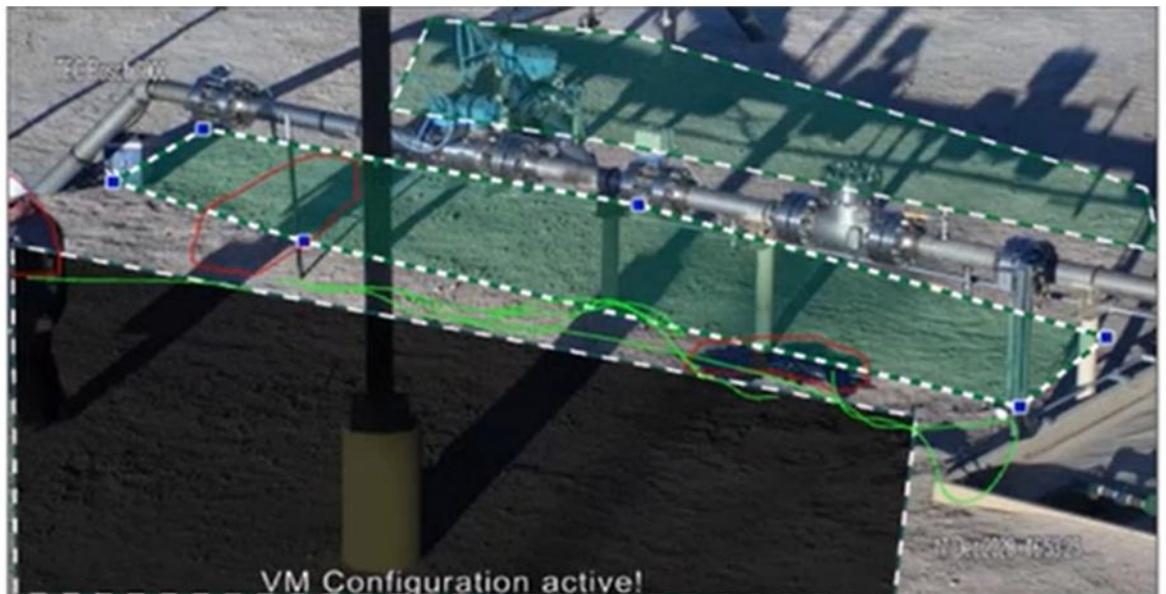
The camera can be programmed with a set of rules that will identify if an item, such as a suitcase, remains static for a set period of time. This is known as “dwell time.” If an unknown item exceeds the dwell time rules, an alert can be automatically sent to have the scene inspected. The camera can also learn environmental patterns, like shadows as the earth moves around the sun, to eliminate false positives. It can detect patterns for human activity and alert if persons enter unauthorized areas.

The Bosch camera can detect any elemental changes to a scene and trigger responses based on a set of user-defined rules. Essentially, it is always asking: “Is there something there that shouldn’t be there? Is there something there that wasn’t there before?” As the environment or scene changes over time, the camera learns and adapts. While other cameras have similar capabilities, these cameras tend to have rule sets based on active motion-based alerting. An example would be detecting that a vehicle entered a restricted oilfield at 2 a.m., and established rules dictate that no vehicles should be on premise after 8 p.m.. This would trigger an alert and response.

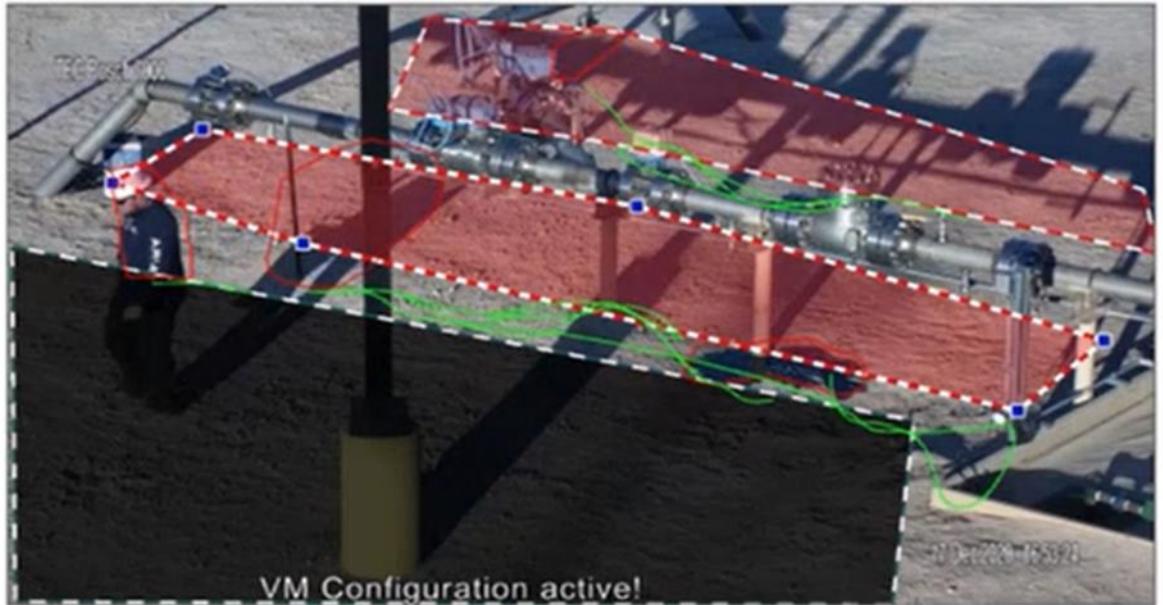
The Bosch camera is unique in that it can also detect smaller, slower changes over time. The AUTODOME 7000i learns that the ground at an oilfield is white sand. It learns the shadow patterns throughout the day and how they shift seasonally. Based on rules, it can also eliminate scene changes caused by weather, such as rain or wind. As it tracks and learns the scene, it can also detect and alert that there is gradual and widening darkening of sand due to a frack water or oil leak.

Alerts can be sent in a number of ways. If an anomaly is detected, the system can send an email that includes a snapshot of the scene. It can send an alert to an alarm panel that can dial out to a central station or remote operations center. Or it can transmit an alarm digitally or virtually to another system that is then programmed to respond according to a defined set of rules. The camera alert can also be piped into a central operations monitoring facility that tracks various metrics for all field operations. In all cases, the alerts happen nearly instantaneously once a “fault” condition has been detected. This is critically important when every second counts as pertains to safety, security, and product integrity.

Shown to the right is an image of an actual leak detection scenario. In this situation, the set delay period for identifying and alerting on a leak is five seconds. This photo depicts the pump area with a possible leak. The monitored area is colored green, indicating no present issues; the area of possible concern has been identified by the IVA in red.



This next photo was taken after the five second delay elapsed. The color change of the area to red indicates an alarm state, and appropriate alerts were sent to personnel to respond to the problem area.



In this case, the Optical Automation solution was able to learn normal

conditions for the monitored area; discount acceptable variants, such as weather and shadowing (none of which shown triggered an alert); detect, tag, and alert of gradual changes in ground color that could be an active leak.

Beyond optical leak detection, Twin Eagle Solutions' Optical Automation technology can also quickly detect variants to defined rule sets. Some examples include:

- Absence of Personal Protection Equipment (PPE) - Corporate policies and state and/or federal guidelines often dictate that employees must wear PPE, like a hard hat, when entering job sites. If any employee enters the site without a hard hat, an alert via text, email, or other means can be sent to relevant personnel to rectify the situation.
- Unauthorized vehicle types - If typical traffic to a work site includes only trucks of various sizes, the presence of a Volkswagen Beetle would be detected by the OA solution. It could then send an alert to security personnel to investigate.
- Unauthorized license plates - Many work sites require license plate registration of authorized vehicles. If a vehicle with an unrecognized plate number enters the site, security can be quickly alerted to respond.
- Unauthorized persons - If there are areas of a facility or work site where people are prohibited, alerts, including a snapshot, can be sent to security if a person enters that area.

In essence, Optical Automation, using the Bosch camera, IVA, and Camera Trainer, can learn to identify and track any number of conditions that a company might want to monitor. It seamlessly bridges the gap between corporate and field operations and allows companies to operate more efficiently and profitably.

The Bosch cameras models utilized in Twin Eagle's Optical Automation solution are as follows:

- Autodome IP Starlight 7000i (NDP-7512-Z30)
- DINION IP thermal 8000 (NHT-8000-F07QS)
- FLEXIDOME IP starlight 8000i (NDE-8502-R)

These industrial grade intelligent security cameras are built to withstand the rigors of any edge-based application while offering state-of-the-art video capability, machine learning, and advanced analytics. Many Bosch cameras, including the Autodome IP Starlight 7000i, are built on an open platform that allows customers to customize and augment the cameras' capabilities with third party apps from the Security & Safety Things app store.

GAINING THE COMPETITIVE EDGE

Optical Automation is and will continue to be a key priority for companies that want to survive and thrive in a changing, potentially turbulent, landscape. As companies – regulated and unregulated – look to OA as a way to streamline operations and optimize workforce efficiency, numerous benefits can be achieved, including:

- Real-time detection and alerts based on user-defined rules
- Significantly improved response times to alerts
- Optimization of personnel to allow them to focus on more complex tasks
- Automation of time-intensive manual tasks, like gauge readings
- Increased accuracy of remote field gauge readings
- 100% site coverage, 24 hours a day, 7 days a week
- Ability to remotely manage field safety and security, e.g., PPE, authorizations, etc.
- Simpler regulatory compliance
- Reduction in regulatory penalties and/or fines
- Predictive maintenance of field equipment via audio/video remote monitoring
- Streamlined communications between corporate and field operations
- Faster, deeper insights into field operations
- Reduction of environmental impact due to early issue detection and repair
- Decreased carbon footprint due to elimination of unnecessary truck runs
- Remote startup and shutdown of facilities reduces risk of fire, explosion, and employee injury

OIL AND GAS GOES GREEN: PROTECTING THE ENVIRONMENT

The O&G industry has made significant strides in lessening impact on the environment in recent years, and Optical Automation can help them expand those efforts. By implementing OA and Remote Site Inspection for all of its facilities, the midstream solutions provider was able to decrease site visits in fossil fuel consuming vehicles by 70-80%.

As a result, they were able to reduce carbon emission by approximately 4,480 pounds per month for every truck in the fleet that had previously been performing daily truck runs. As more O&G companies expand their use of OA and RSI, they can achieve significant industry-wide reductions in carbon emissions and help preserve the environment for future generations.

APPLICATIONS BEYOND OIL AND GAS

While this paper explored an RSI project at a midstream produced water solutions provider, Optimal Automation has numerous applications for other industries, including:

- Refineries that must monitor combustible components and industrial grade machinery can do so remotely.
- Nuclear Power Providers can respond faster to any detected issues or anomalies, utilize predictive maintenance to keep equipment in peak operating form, and minimize risk of fire and/or explosion during its most critical periods – plant startup and shutdown.
- Shipyards that store ships with hybrid motors (electric motors using natural gas or hydrogen) using volatile materials that must be closely monitored remotely to minimize risk of fire and/or explosion.
- Foodservice, Medical, and Marine Industries which require stainless steel housing and pure aluminum construction on all components in working areas can use OA to monitor operations, industrial machinery, and safety and compliance with all statutory and regulatory requirements.

INTERESTED?

LEARN MORE ABOUT HOW OPTICAL AUTOMATION CAN IMPROVE YOUR OPERATIONS, BRIDGE THE GAP BETWEEN CORPORATE AND FIELD OPERATIONS, AND GIVE YOU THE COMPETITIVE ADVANTAGE.

TWIN EAGLE SOLUTIONS
SALES@TWINEAGLECONSULTING.COM
303-710-8000