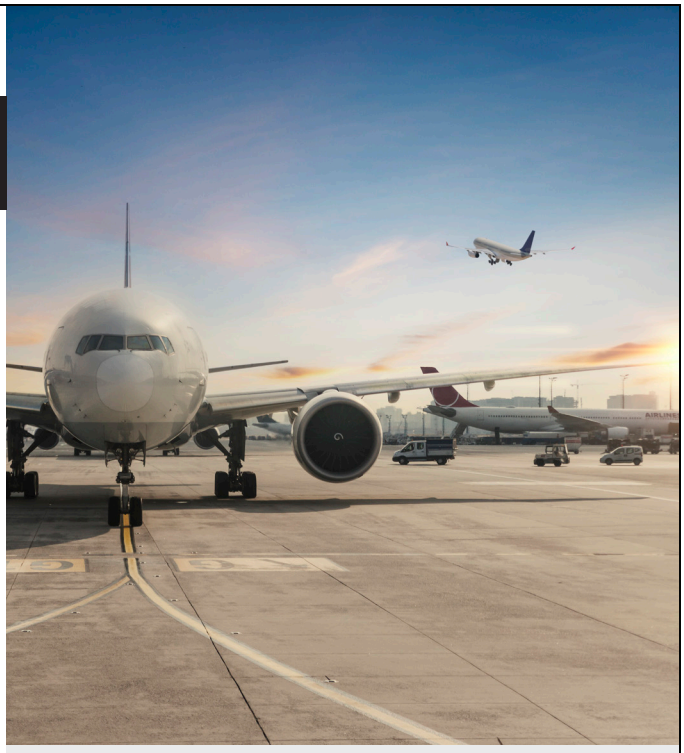
WHITE PAPER – Critical Infrastructure

HOW LAYERING MULTISPECTRAL PTZ CAMERAS AND RADARS IMPROVE PERIMETER PROTECTION

FLIR Critical Infrastructure White Paper



EXECUTIVE SUMMARY

Critical infrastructure sites rely on perimeter intrusion detection systems to detect approaching people or vehicles that could pose a threat to the enterprise. Traditional sensors used for these security systems include fiber optic cables, microwave sensors, visible cameras, and fence shakers. Today, security directors and system integrators favor layering multispectral (thermal and visible) PTZ cameras with radars to increase the probability of detection and reduce false alarms. This white paper explores the advantages of implementing a perimeter security system that combines radar technologies with thermal multi-sensors to achieve greater site coverage, deliver higher performance, and reduce total cost of ownership.

INTRODUCTION

Outdoor perimeter security systems provide the first layer of protection for mission-critical enterprises. Designed for 24/7 intrusion detection, these systems identify threats, track targets, and notify security personnel when intervention is needed. Perimeter intrusion detection systems, commonly referred to as PIDS, are essential facets to the successful operation of critical infrastructure sites such as utilities, airports, datacenters, and oil and gas facilities. If unauthorized individuals were to breach the perimeter of any critical entity and sabotage key equipment, asset failure could lead to widespread disruptions in vital services for millions of customers. This is one of the factors driving perimeter protection investments. In fact, the critical infrastructure protection market was valued at $70.92 billion in 2019 and is expected to grow to $108.17 billion by 2025, according to Mordor Intelligence.[1]

While the importance of securing critical infrastructure sites from intruders is clear, designing outdoor perimeter systems is no straightforward task. Remote locations, uneven terrain, wildlife, inclement weather, adverse lighting conditions, and compliance regulations, are all factors that security directors must address. It takes strategic planning, often with help from consultants and systems integrators, and thorough knowledge of the latest sensor technologies to design an effective perimeter system that will perform in harsh environments.

Thermal imaging cameras offer 24/7 monitoring, increase the probability of detection, and reduce false alarms.

[1] Critical Infrastructure Protection Market – Growth, Trends, and Forecast (2020-2025)," Mordor Intelligence, LP, accessed April 3, 2020, published February 2020, https://www.mordorintelligence.com/industry-reports/global-critical-infrastructure-protection-market-industry

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TRADITIONAL PIDS TECHNOLOGIES

There are several technologies that customers have implemented in their PIDS over the years. Buried cables, optimal for covert operations and maintaining site aesthetics, leverage sensors in the ground to detect the movements of intruders walking or crawling over defined lines. Fence detection systems use sensors embedded in the fence line to detect when someone attempts to climb or cut the fence. Microwave sensors, placed above ground, emit an invisible field of energy and send system alarms when an intruder walks between the transmitter and receiver. All of these technologies are effective in their own right. However, fiber optic cables and fence shakers only monitor perimeters and boundaries. They only alert when someone is "at the gate." They do not give any advanced warning and underground technologies can be quite expensive to install.

At the end of the day, end users want to expand monitoring beyond the perimeter. They want to receive early warnings of approaching threats so they can initiate a response to de-escalate the situation before the intruder reaches the perimeter. A PIDS that meets this demand, increases site coverage, and improves detection accuracy is the most attractive option.

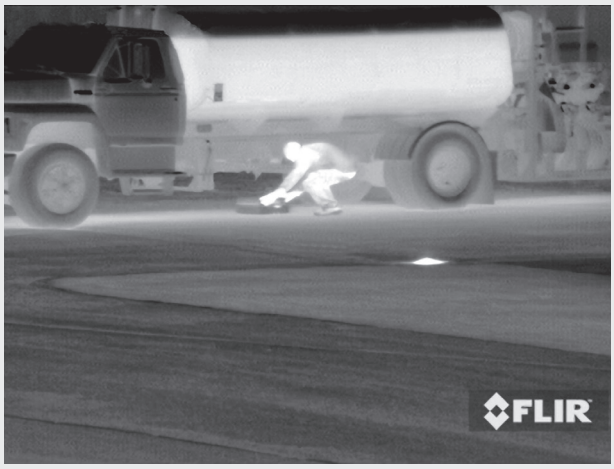
A TRUSTED OPTION

A trusted strategy when designing a PIDS is to layer multiple sensor technologies. Thermal imaging cameras and radars are prominent sensor technologies that effectively increase coverage footprint and efficiency for PIDS projects.

While these technologies have been used together in the military and defense sector for years, they are now more accessible to the private sector. Thermal imaging cameras and radars have a track record of performance in extreme outdoor environments and are seeing greater adoption from critical infrastructure organizations, such as substations, data centers, airports, as well as other industrial industries.

For example, the thermal imaging market—comprising the building inspection, maintenance, elevated skin temperature, surveillance, fire-fighting, personal vision systems and drones segments—is projected to reach $7.5 billion in market value by 2025, growing at a compound annual growth rate of eight percent from 2019-2025, according to Yole Développement.[2] Yole also forecasted that the radar market, specifically the defense, security, and aerospace segment, will grow from $11 billion in 2019 to $13.1 billion in 2025.[3] The main takeaway is that demand and sales for thermal cameras and radars is on the rise. This growth demonstrates the trust and interest that customers across verticals have in these technologies, providing another reason why these multi-sensor solutions should be considered for PIDS projects.

Layering multiple sensor technologies improves PIDS performance and coverage.



Thermal cameras detect humans, vehicles, and objects in complete darkness and other low-visibility conditions.

[2] Dimitrios Damianos and Eric Mounier, "Thermal Imagers and Detectors 2020 (Market & Technology Report)," Yole Développement, published November 2020, accessed March 24, 2021, https://s3.i-micronews.com/uploads/2020/11/YDR20133b-Thermal-Imagers-and-Detectors-2020-Flyer.pdf

[3] Cédric Malaquin and Antoine Bonnabel, "Status of the Radar Industry: Players, Applications and Technology Trends 2020 (Market & Technology Report)," published May 2020, accessed March 24, 2021, https://s3.i-micronews.com/uploads/2020/05/YDR20084_Status_of_the_radar_industry_2020_Flyer.pdf

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THERMAL CAMERAS SEE WHAT OTHER SENSORS CANNOT

While conventional surveillance cameras are the most effective options to meet color video, feature identification and evidentiary standard requirements in security deployments, for installations with harsh imaging conditions, where optimal lighting is not available, a different sensor solution is needed. In these scenarios, thermal cameras are ideal. Here are the key reasons why thermal cameras present an advantage for applications characterized by low-light or no-light, adverse environments and video analytics.

Thermal cameras see what the naked eye and standard cameras do not: heat. They can measure differences in heat signatures among humans and objects as minute as 0.01°C and reflect these differences in an image. For this reason, thermal cameras offer several benefits to security buyers.

Thermal cameras produce images in conditions standard surveillance cameras cannot, allowing security operators to see in total darkness, harsh sunlight, glare, rain, and smoke. Thermal cameras truly enable 24/7 surveillance, which is a capability that distinguishes them from other sensors. Thermal cameras satisfy regulations such as U.S. NRC's 73.55 security policy, which requires nuclear power plants to provide "continuous surveillance, observation, and monitoring" of areas "to detect and deter intruders." Thermal cameras detect humans, vehicles, and objects in complete darkness and other low-visibility conditions.

Thermal cameras deliver high-contrast imagery optimal for video analytics performance and intrusion detection. When deploying thermal cameras, command center staff can easily see an intruder attempting to hide in the trees at night, whereas a standard security camera would only show a dark image.

Security directors are opting for thermal cameras with video analytics for their PIDS because they provide both intrusion alerts and visuals for alarm verification, functioning as a more turnkey solution. While fiber optic cables or fence shaker technologies provide intrusion notifications, they require another solution for video verification to validate the alarm. This is not the case with thermal or visible cameras with analytics, which provide both intrusion notifications and video of the alarm event.

Thermal cameras also appeal to system integrators for PIDS projects from an installation standpoint. For oil and gas facilities, ports, and other sites, where installing a fence line along the entire perimeter isn't possible, thermal cameras with analytics serve as a cost-effective alternative, creating a "virtual thermal fence" for intrusion detection. With lower construction costs than a continuous physical barrier, thermal virtual fence lines provide similar deterrence to a physical fence with the added benefit of proactive alarming when threats approach.

With over 40 years of expertise, FLIR Systems is the global leader in thermal technology and has a full suite of thermal solutions for critical infrastructure applications. **FLIR thermal security cameras** are the premier choice for perimeter monitoring solutions for mission-critical enterprises.

Layering multiple sensor technologies improves PIDS performance and coverage.

Integrated radar solutions give operators the power to remotely monitor target movement.

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RADARS AS SUPERIOR DETECTION DEVICES

Radar adds another layer of security within a PIDS solution, complementing visible and thermal security cameras by providing coverage beyond the fence line. Ground-based radars use high-frequency radio waves to detect moving objects. Conducting full 360º scans of a property every 1-2 seconds, radars provide continuous site coverage. They are almost unparalleled as detection devices, providing a far longer and wider detection range than a typical camera system. They operate in darkness, rain, and other adverse conditions. Once they detect a potential intruder, radar sensors pinpoint the exact GPS coordinates of the target. When radar is integrated with command and control software, the software can put the target on the map to show the direction a target is travelling. This allows security personnel to track a person's movement continually, both in and outside the perimeter.

Radar options are effective and give security staff early warnings of approaching intruders or unauthorized vehicles. Upon detection, security personnel can initiate procedures before the potential intruder is able to reach a perimeter, giving security personnel the opportunity to address a potential threat before it becomes problematic.

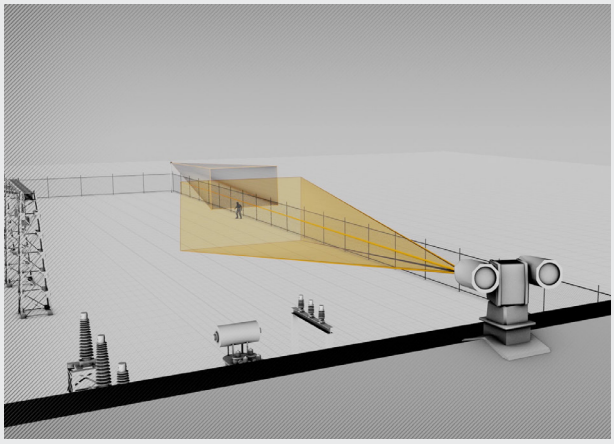
LAYERING THERMAL MULTI-SENSORS AND RADAR FOR SUPERIOR RESULTS

Radar is arguably the best available technology for detection of threats over large areas and at long ranges. While radar provides excellent coverage and tracking, it does not provide visual verification of threats to separate real threats from false alarms. As a result, customers are layering thermal cameras, particularly pan-tilt-zoom (PTZ) dual sensor cameras with thermal and visible imagers, with radar for a robust PIDS design. One of the key advantages of integrating multispectral cameras with radars is that customers gain redundancy. With sophisticated software that accurately combines alarms from both thermal, visible and radar sensors, users increase the probability of detection. If both sensors send an alarm on the same event, it is likely a true alarm. This helps reduce false alarms and allows security operators to dispatch a security response with high confidence that the threat is real.

A properly designed thermal-radar PIDS also improves target tracking. Radars can track multiple targets at a time. Their sophisticated, onboard software detects targets and continues to track them until they leave the monitored area. When integrated with a multi-sensor PTZ camera equipped with both thermal and visible payloads, the radar cues the PTZ camera to automatically follow and zoom in on the moving target. This allows security personnel in a remote command center to have eyes on the target at all times, improving overall threat assessment and real-time response.

EFFICIENCY AND COST-SAVINGS

PIDS using thermal cameras and radar minimizes equipment costs. Radar will have a much greater coverage area than cameras alone or other traditional sensors. Achieving greater coverage through fewer devices reduces upfront equipment and installation costs. For some deployments, installation for a PIDS utilizing both multi-sensor PTZ and fixed thermal cameras as well as radars can be streamlined. When a site has existing facilities, lattices and poles, cameras and radars can be mounted on these structures.



PTZ cameras continuously track moving targets when cued by radar.

Security VMS

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Integrating thermal cameras with radar also reduces maintenance costs. When radar cues a PTZ thermal camera, the camera only moves upon detection. This ensures the camera's PTZ mechanism is only engaged when needed, extending usable life of the camera and reducing wear and tear.

Case in point, in 2016, an electrical utility sought to enhance and potentially replace traditional fence protection systems—such as fiber optic cables, microwave barriers, and video analytics—as these systems all required extensive labor, time, and capital for implementation. The utility partnered with VTI Security, a leading system integrator with years of expertise in the commercial, utility, and oil and gas sectors. **VTI recommended a solution** that integrated **FLIR Triton™ PT Series cameras** alongside radar solutions. The combination of the thermal and radar technology enabled the customer to locate a person within a 100-acre space and see hundreds of yards beyond the fence line. Additionally, the radar cued the camera and triggered alerts to personnel without operator intervention. The automated functionality streamlined operations and efficiency. Because the thermal-radar solution was easy to install, VTI deployed the solution at 25-30 sites in just three months. In fact, installation occurred about four times faster than anticipated.

KEY TAKEAWAYS

Designing perimeter intrusion detection systems for critical infrastructure sites requires both innovation and expertise. Security decision-makers must satisfy compliance regulations, determine the effectiveness of sensor technologies, evaluate the costs associated with each technology option, ensure technology compatibility, and work with within budget constraints to satisfy customer requirements.

Fortunately, pairing thermal multi-sensor PTZ camera options with radar for PIDS is proving to be an effective and efficient option. Integrating these cameras with radar maximizes site coverage, detection accuracy, target tracking, and early warning while minimizing infrastructure and construction overhead. As more critical infrastructure customers see the advantages of deploying a PIDS using thermal multi-sensor cameras and radar, there will be a continuously increasing number of deployments of thermal-radar solutions at substations, data centers, airports and oil and gas facilities.

ABOUT TELEDYNE LLC

For the security sector, Teledyne FLIR offers advanced video and sensor technologies designed to meet complex border, critical infrastructure, safe city, and commercial enterprise needs. Signature products include thermal cameras, visible light cameras, radars, video management systems, unmanned aerial vehicles, and physical security information management solutions.

For more information, please visit **www.teledyneflir.com**

With over 40 years of expertise, FLIR Systems is the global leader in thermal technology for critical infrastructure applications.

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