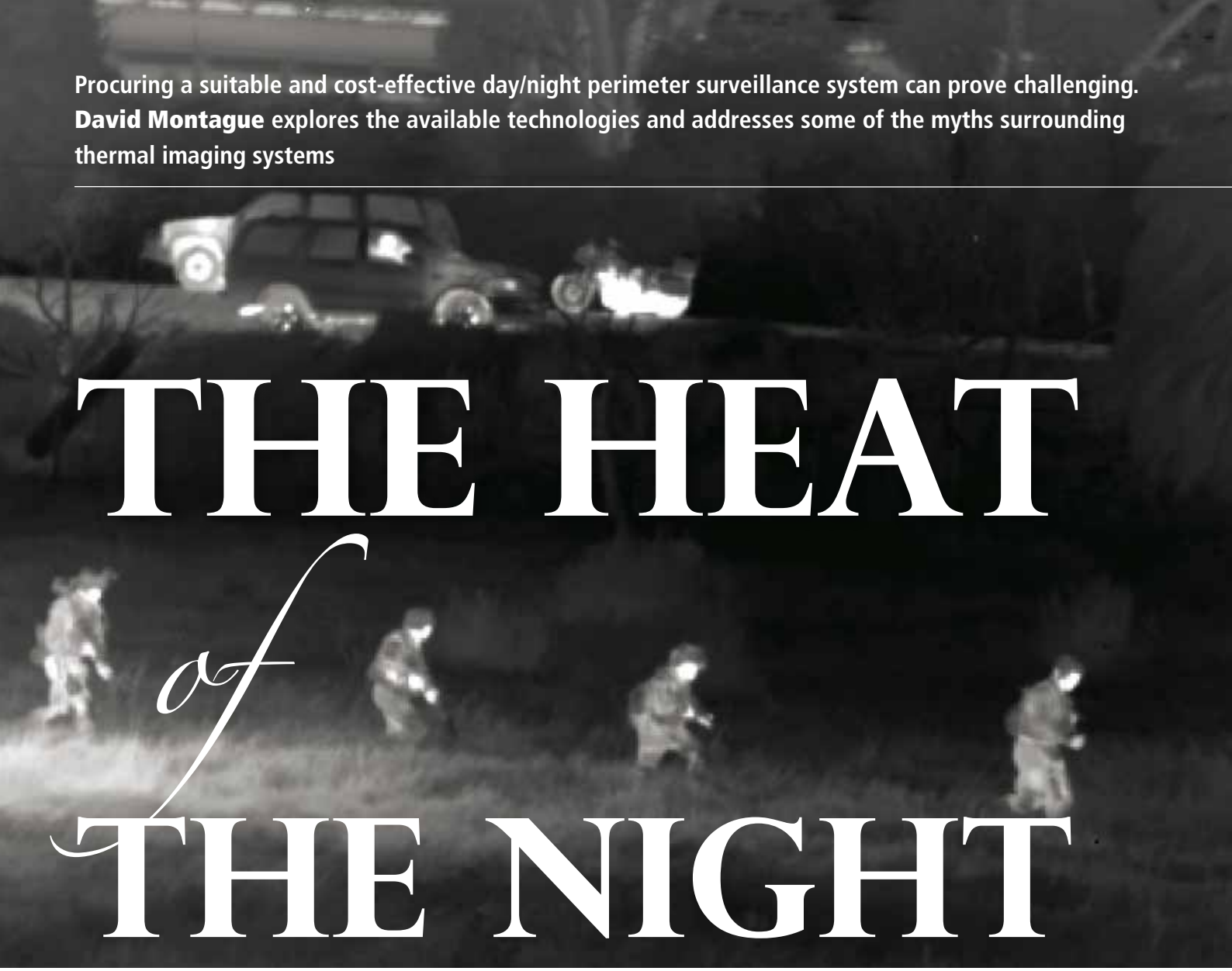
**Procuring a suitable and cost-effective day/night perimeter surveillance system can prove challenging. David Montague explores the available technologies and addresses some of the myths surrounding thermal imaging systems**



# THE HEAT of THE NIGHT

Thermal imaging technology is now generally considered a tried-and-tested technology, and is used in numerous professional surveillance and perimeter security installations around the world. The potential benefits are huge, with thermal security cameras allowing security teams to see intruders and other threats to their facilities clearly in total darkness and in bad weather. And yet even some professional users and buyers are still confused by misconceptions about the technology which might prevent them from choosing a thermal imaging system. In this article, we will discuss some of these reservations and attempt to shed some light on the issues.

The first reservation many buyers have is price. What does it cost to secure your perimeter 24/7 and are thermal imaging cameras more expensive than other technologies? As CCTV systems become more advanced, the security industry will increasingly focus on CCTV installations for 24-hour surveillance, not just day-time operation. To be truly secure, a site must be protected day and night. A number of tools are available to help detect potential intruders in the dark. Often different technologies are being combined to create a secure perimeter. Fences can be complemented with closed-circuit television (CCTV) systems, with or without active infrared illumination or old fashioned light bulbs, radio frequency intruder detection (RAFID) systems, thermal imaging cameras and/or walking patrols.

To get a full picture of the total cost of ownership (TCO) for a certain solution, the installation and maintenance costs need to be considered as well as the initial purchase cost. Some solutions consume a lot of power and need a lot of spare parts, for example; it will become increasingly important to save energy by examining running costs. Local authorities and private industries are all looking at methods to save energy costs, and lighting is one area that will receive due attention.

Quite a number of technologies are available to help detect potential intruders in the dark before they become a real hazard. Let's compare some of them. Firstly CCTV systems, which are effective for security and surveillance applications but which have very limited range in total darkness. So, in order to detect intruders at night, they are often complemented with light emitted from mains-driven bulbs. Although some bulbs (fluorescent lamps, HID lamps) are more efficient than others, the operational cost of such systems remains very high. Full-spectrum light can also only penetrate a relatively small distance, and it is therefore not always possible to completely illuminate an area sufficiently that it can be kept under CCTV surveillance. Maintaining the lights is also very costly; CCTVs with traditional lamp lighting require lamp replacement every 2,000 to 4,000 hours, or about every eight months.

Compared to traditional light bulbs, LEDs provide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significant savings on electrical consumption. LEDs also provide long life performance with little ongoing maintenance costs. Infrared illumination with LEDs, sometimes also called active infrared, shines infrared radiation into the area in front of a camera from LED lamps placed around the lens of the camera. LED illumination is compromised by limited range performance, however. Also, providing lighting for domes has long been a challenge for CCTV professionals as the lighting cannot be fitted to move with the camera.

To further increase security, fences can be equipped with sensors that generate an automatic alarm when touched by an intruder. While sensitive and in many cases low maintenance, such fences-based systems need to be complemented by longer-ranged systems such as CCTV cameras or walking patrols in order to establish a picture of what is happening around the fence.

Similarly, RAFID uses two specially designed cables – one transmitting a radio wave while the other receives that wave. Changes in the amount of signal passing between the transmitter cable and receiver cable are analysed by a signal processor. These changes indicate that someone or something is between the two cables, which will make an alarm go off. Due to the difference in signal strength, the system can detect whether these changes are due to the presence of a human or a small animal, for example. In many cases CCTV cameras still need to be installed in order to see what is generating the alarm, however.

Finally, thermal imaging cameras produce images of invisible infrared or "heat" radiation. Based on temperature differences between objects, thermal imaging produces a crisp image on which the smallest of details can be seen. They work both during daytime and nighttime and the latest systems, such as those which contain an uncooled Vanadium Oxide detector, not only produce excellent quality thermal images but also require no additional lighting or illumination and have no regular maintenance costs.

Let's take a look at an example. Below is a comparison between the required number of units for perimeter protection systems based on CCTV cameras versus systems based on thermal imaging cameras. Say we want to protect a high-security perimeter of 700 meters. The perimeter needs to be secured day and night, in all weather conditions. This means that CCTV cameras are limited in terms of distance that can be covered by the infrared illuminators.

In this simplified example, the cost of personnel and equipment during the installation and the cost in maintenance and power bills are not included, as they might vary strongly depending on available infrastructure, local power rates and local wages. In all cases these costs will be directly proportional to the amount of equipment and on the usage of lighting.

| **CCTV cameras** | **Units** |
|---|---|
| D/N camera with outdoor housing and 19mm lenses | 12 |
| Pole and pole basement | 12 |
| IR lamp | 12 |
| Video analytics license | 12 |
| Input on DVR or nDVR | 12 |

| **Thermal imaging cameras** | **Units** |
|---|---|
| Thermal imaging camera | 5 |
| Pole and pole basement | 5 |
| IR lamp | 0 |
| Video analytics license | 5 |
| Input on DVR or nDVR | 5 |

# THE HEAT OF THE NIGHT

Even though the price of one single thermal imaging camera might be higher than the price of a CCTV camera, the overall investment costs for a thermal imaging camera perimeter protection system is actually lower – in this case 28 per cent lower. The larger the perimeter, the bigger this difference will become. Since thermal imaging cameras require no lighting to function, and given the fact that fewer cameras are needed with the thermal imaging perimeter protection solution, this system will also consume less electricity than the CCTV solution, making the thermal solution less expensive in its upkeep than the CCTV solution.

The second reservation many potential buyers of thermal imaging cameras have is around durability. Once the investment for thermal imaging cameras has been made, it is important to know whether these cameras are durable and built to last. Perimeter security cameras have to endure a lot, due to their outdoor installation. Lightning strikes, for example, can cause irreparable damage to outdoor cameras. Outdoor cameras are often installed in remote locations which require them to rely on sometimes poor quality power. Poor input power quality may be compounded by the injection of noise, voltage spikes and transients onto the power, Ethernet and video coax cables along the long cable runs to each camera.

In order to better protect its thermal security cameras and safeguard the investment made, manufacturers like FLIR Systems provide thoughtful designs that ensures the survivability of the camera in electrically adverse environments. The cameras have been engineered to provide a high degree of protection against a variety of problematic power, communication and video signal conditions that can cause problems for cameras. The FLIR FC-Series S, for example, uses a rugged aluminum alloy case which provides both physical endurance and protection and significant shielding. It fully encloses the electronics inside and minimises any interference from the local environment with the camera operation. The case should be connected to an earth ground, and a threaded stud is provided for this purpose. This ground connection is a critical part of the protection technologies. This allows any discharges to be quickly and safely conducted to ground.

Circuitry protection will also provide protection against electrostatic discharge (ESD) damage which could be induced by an ungrounded installer. Cameras should be designed to be opened for easy cable installation, and installers should not need to take special precautions (static wrist straps, etc) when connecting wiring since all the contact points should be fully protected against static discharge.

The best systems will be designed for applications that are exposed to lightning and will feature protection circuitry that only allows the intended signaling to pass through. The danger from lightning is not that the camera will be hit by lightning (a rare event) but that nearby lightning will cause large electrical surges on wiring. The FC-Series S, for example, provides protection from 4000V surges on its interfaces, while typical products provide 1000V of protection. As is common in high-risk environments it is recommended that such protection be augmented with primary lightning protection at the installation site, including lightning rods and arresters.


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***Based on temperature differences between objects, thermal imaging produces a crisp image on which the smallest of details can be seen***

Poor quality power supplies which do not effectively filter power, poor quality local power, power disturbances, or a significant distance between the power supply and the camera can all be sources of voltage dips and surges. The best systems will feature significant immunity to abnormalities on its power lines such as voltage dips and surges, fast transients, short interruptions, and conducted RF disturbances.

The third and final reservation some potential buyers have is over performance. Such reservations disappear very fast from the moment users experience what thermal imaging technology can do. For starters, thermal imaging cameras allow you to see in total darkness. Since everything generates heat, thermal security cameras can see as well at night as they can during the day. Cameras dependent on visible light are useless at night or in poor visibility without supplementary illumination from lights or lasers.

Thermal energy also passes through many obscurants including smoke, dust, modest foliage and light fog. In most cases, thermal energy travels through the atmosphere more effectively than visible light. As a result, thermal imagers can see activity at extreme ranges, while visible cameras, which rely on colour contrast, fail.

Additional technology innovations like Digital Detail Enhancement (DDE) and Wide Dynamic Range (WDR) make sure that you see high contrast thermal images in the most diverse conditions. The latest cameras provide high quality thermal images even when the sun is in the field-of-view but also in cold and low-contrast thermal scenes. This is ideal for use with video analytics that need properly contrasted images in order avoid generating false alarms.

Security technology buyers therefore have fewer and fewer reasons to doubt thermal imaging. Certainly the technology has now become more cost-effective than ever before. In the perimeter example given above, the overall investment costs for a thermal perimeter protection system are actually lower than for a traditional CCTV system. Add to this the extreme durability and high performance of thermal imaging cameras, and you have a risk-free investment that will protect your perimeter for many years.

**David Montague** is Sales Director, Europe and Sub-Saharan Africa for FLIR Commercial Systems. He was worked extensively in the international security market for 15 years and has held his current position for five years, regularly advising agents and users on best use of thermal cameras for border and perimeter security.