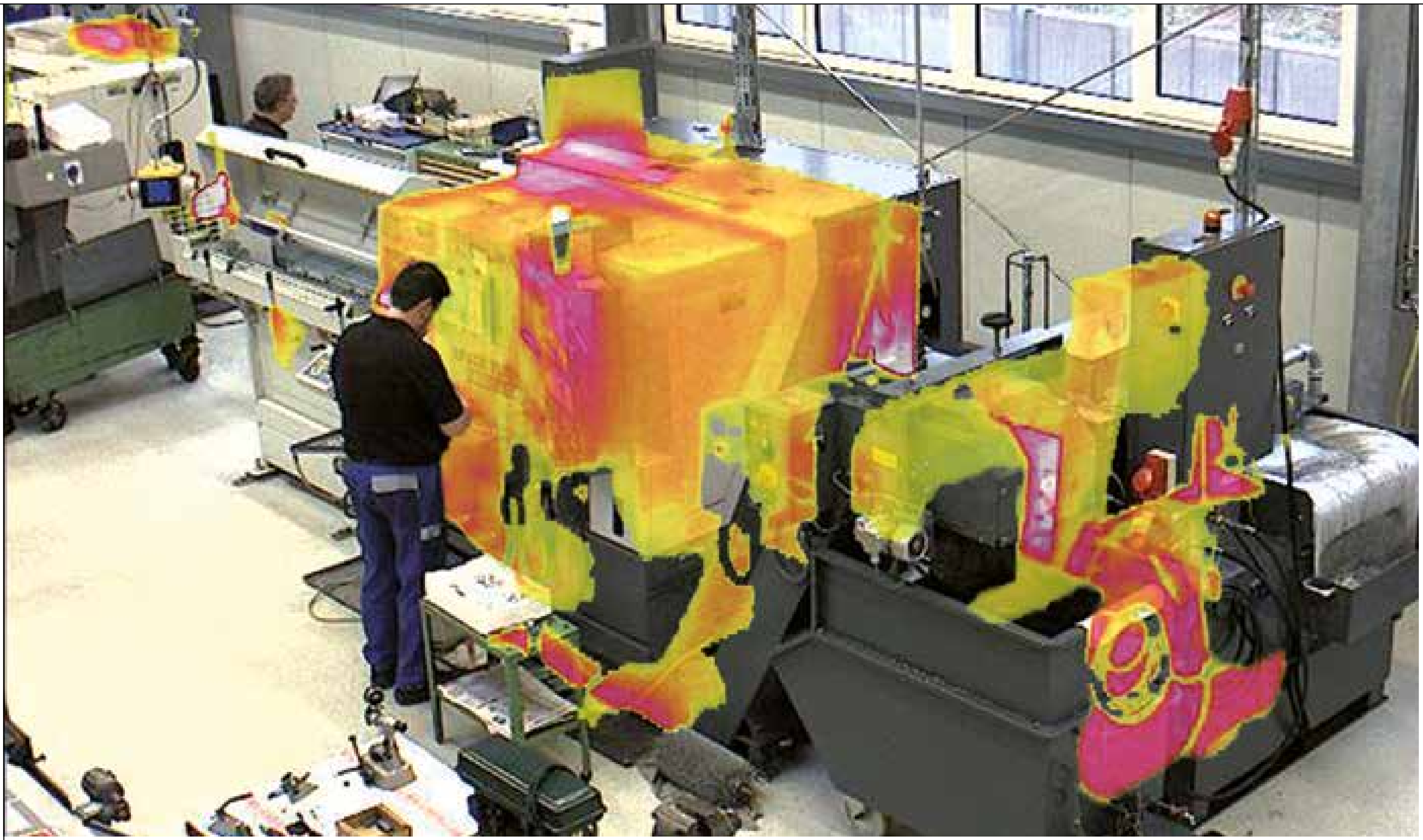


Picture credit: MOBOTIX

UNDERSTANDING THERMOGRAPHIC IMAGING

Trevor Holt *offers an overview of thermal imaging technology*

Thermographic imaging has a number of uses in industry, law enforcement and search and rescue

Thermographic imaging is the ability to detect infrared energy, which is emitted from objects as they become hotter. The technology has been around for almost 90 years and initially found favour in military applications and in recent years within search, rescue and law enforcement use cases. Although an established technology, its widespread adoption has been hampered by a number of factors. The first inhibitor has been cost. Traditional thermal imaging cameras use special sensors in combination with a precision lens made of germanium or sapphire that allow long wave infrared waves to pass through, unlike the blocking nature of traditional glass lenses. The specialist componentry and relatively small production runs had led to higher costs with cameras priced from the thousands to tens of thousands of pounds depending on the sensitivity and features of each device. Another inhibiting factor was size. Many earlier models would require special casings including cooling, which tended to result in a large footprint – making deployment impractical in certain environments.

However, the digital revolution of the last two decades has led to newer types of sensors, smaller yet more powerful components and lower power consumption removing the need for additional cooling. The advancement in technology along with more mass production has led to a new category of all-digital entry-level uncooled thermal cameras at price points under 2000 Euros that is attracting new civilian customers with uses as diverse as manufacturing, waste management and fault detection. Although still a small market, it is growing fast with research company HIS predicting that uncooled thermal cameras in just the commercial security area – which was worth $245m in 2014 – will grow to nearly $500m by 2019.

The new range of thermal cameras operate in a similar fashion to legacy models in that they detect the mid-wavelength infrared radiation from an object or body otherwise invisible to the human eye caused by thermal motion within a body's molecules. This is the result of accelerated charges that emit radiation in accordance with the laws of electrodynamics. Thermal Radiometry imaging technology captures and displays temperature distribution across surfaces and objects with heat intensity information displayed as an overlay of artificial colours with blue identified as cooler and red as warmer.

Unlike megapixel resolution, which is often used to define the quality of traditional video surveillance systems, thermal cameras use a Noise Equivalent Temperature Difference rating (NETD), which is expressed in milli-kelvin. For example, the new MOBOTIX thermal cameras can visualise temperature variations starting at 0.05°C, which places them in the top range of cameras that is currently available for general use. The cameras also feature spot metering, allowing accurate temperature measurement in the centre of the sensor.

The primary application for thermal imaging is still area surveillance during night-time or low-visibility situations. Thermal imaging provides a view even in complete darkness and unlike motion detection systems that are limited in range and generate false alarms due to environmental factors such as swaying trees, mounting poles or even wild animals. Thermal imagery provides approximately the same level of detection capability day, night and in most weather conditions. This capability is highlighted at a deployment at Transport for London, where the manager of the London Underground has recently deployed thermal imaging to protect a core maintenance facility that holds millions of pounds worth of machinery and spare parts needed for both routine maintenance and on-going improvement work. The thermal camera watches over an area that due to its trackside location, cannot have powerful lighting, yet needs to be accessible 24 hours a day.

Another application is the deployment of thermal cameras on buses within the Los Angeles metropolitan complex that are able to capture images of the route ahead for health, safety and for capturing any potential road traffic incidents even in compete darkness.

However, the ability to detect heat is also incredibly useful in many additional scenarios. Thermal technology is used less for measuring the exact surface temperature of an object, but rather as a method to recognise potential dangers from sudden increases or decreases in temperature and to react without delay. For example, a smouldering fire within a waste management situation, which might be invisible to the naked eye or sudden gas or liquid leak, which may cause a rapid decrease in temperature are both situations that can be detected across great distance in any lighting condition.

A great example of this in action is at ZAK (Zentrale Abfallwirtschaft Kaiserslautern), a municipal waste management company that uses mechanical biological treatments (MBT) to sort waste for recycling along with other processes such as composting and anaerobic digestion along with a biomass heating plant for energy generation.

The facility in Kaiserslautern, Germany stores and processes thousands of tonnes of mixed waste and biomass fuel each month, and uses many temperature-sensitive tasks that can be the trigger for fires. Alongside traditional smoke detectors,

THE MAIN APPLICATION FOR THERMAL IMAGING IS STILL NIGHT-TIME AREA SURVEILLANCE

ZAK uses thermal cameras to monitor combustible material storage and fermentation areas that can automatically detect events within a range from -40 to 550°C and are able to operate as an automatic alarm when certain temperature thresholds are reached. Thermal cameras are installed at locations that monitor materials brought in by trucks as well as a material transported by crane so it can be fed into the incineration process. During operation, the thermal camera can recognise automatic temperature events in the complete sensor image or in up to 20 different TR measurement windows with individual temperature triggers.

"We can know exactly how high the temperature is in the timber shelter and can take countermeasures if necessary," explains Michael Hentz, IT and telecommunications manager at ZAK, "These cameras are particularly excellent because they are robust, low-maintenance and weatherproof. These features play a very critical role because dirt is omnipresent at the waste management facility. And of course, this dirt collects on the cameras, as well. But the MOBOTIX models continue to perform well. They've really proven themselves".

ZAK is not alone. A number of manufacturers across Germany are also using thermal imaging to detect abnormal heat build up within production line equipment for both health and safety and to assist with preventive maintenance. This is particularly useful in facilities where dust, steam and other airborne particles may disrupt the monitoring of temperature-critical processes. Another major advantage of newer thermal cameras is the use of decentralised technology using built-in processing software to analyse a scene and generate automatic alarms without the need for a centralised control room. This capability is vital to rapidly detect potential fire, gas or other issues that register temperature change as a danger signal. In combination with lower power consumption, a rugged IP66-rated chassis and small form factor; the new thermal cameras can be deployed in even the harshest locations that legacy cameras would struggle to operate for an extended period.

Although offering many benefits, thermal imaging has a number of limitations. Thermal systems are less effective during fog and rain, which can reduce range due to scattering of infrared light off droplets

THERMAL CAMERAS IN THE COMMERCIAL SECURITY SECTOR WILL GROW TO NEARLY $500M BY 2019

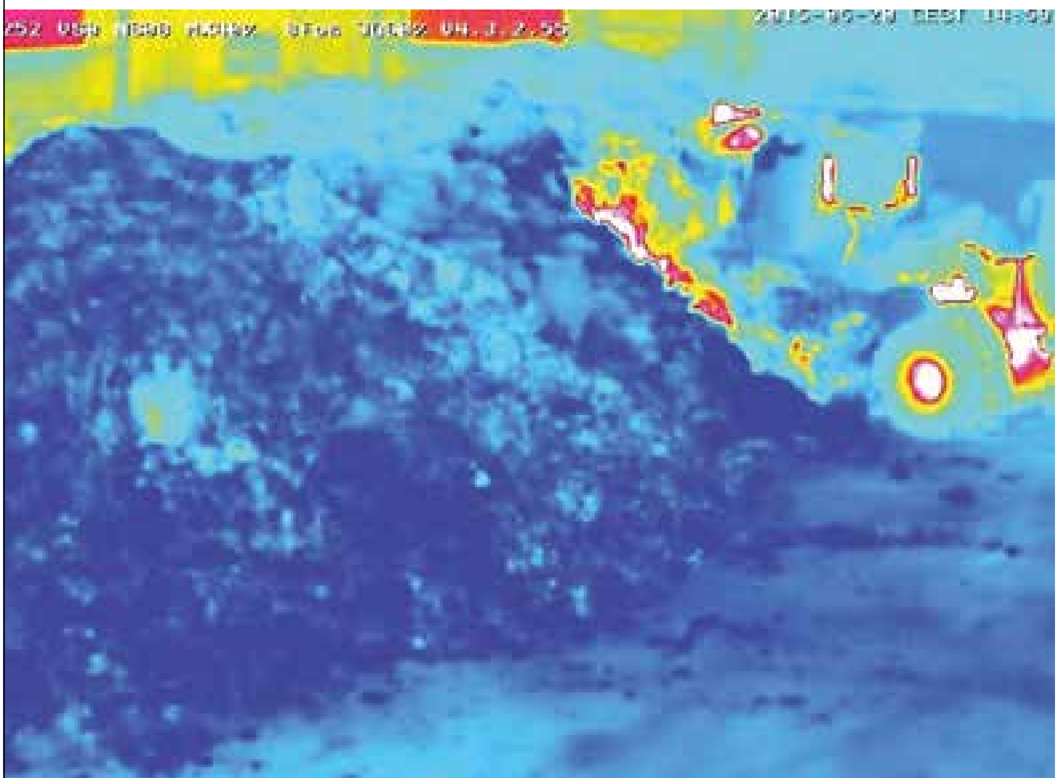
of water. Thermal cameras are not designed to see through an object, but merely to detect surface temperature of objects. This means that certain materials such as a pane of glass between any thermographic camera and the object to be detected will block thermal radiation making a camera's placement a key consideration.

The image produced by thermal cameras is of a lower visual resolution than that of megapixel digital video. As a result, many modern systems offer a combination of thermal and optical sensor technology to provide reliable and simultaneous temperature detection and visual verification.

Although the thermal image capturing process is similar between different types of camera, how that image is processed and the information that can be passed back to an operator can vary a great deal. More basic models are only able to capture data that is sent to a local monitor or central location for viewing, analysis, event triggering and storage. More modern thermal cameras using decentralised technology can use built-in processing software to perform analysis to generate automatic alarms based on not just temperature events, but also events within the scene such as movement, direction of travel and data from additional sensors including sound, humidity and GPS locations for mobile applications. With more intelligent decentralised systems, alarm thresholds can be set in software and triggered without the need for a centralised control room, which is vital to rapidly detect potential fire, gas or other issues that register temperature change as a danger signal.

Thermal imaging is one of the most exciting technologies within the area of video surveillance with on-going innovation demonstrated through this new generation of devices that combine multiple sensors within smaller yet lower cost devices. As video analytics technologies progress, these benefits will be passed on through upgrades to the built-in software to help users to protect their capital expenditure investments ●

Trevor Holt is Business Development Manager UK and Ireland for MOBOTIX and has over 30 years in the Security and Fire Industry. He was part of a team that in 1987 worked to create a four-hour fire standard for doors and shutters as a result of the Popplewell Inquiry. Trevor sites his time at MOBOTIX with the same enthusiasm that drove him in his early years within the industry.



Blue is identified as cool while red is warm

Picture credit: Getty