



# FLIR

## APPLICATION STORY



## FLIR Systems ThermaCAM™ S60 infrared cameras contribute to keeping the London Underground running

*Loved and cursed alike by locals, admired by others, the Underground is the first and largest subterranean railway in the world and one of the world famous landmarks of London. The system carries 2.5 millions of passengers daily in one of the world's most vibrant and tourist capitals. Metronet Rail is responsible for keeping nine of the twelve "Tube" lines up and running. Four FLIR Systems ThermaCAM S60 infrared cameras assist into making this tour de force a success.*

A private sector consortium consisting of Atkins, Balfour Beatty, Bombardier Transportation, EDF Energy and Thames Water, Metronet has a 30 - year "Public Private Partnership" contract with London Underground. Under this contract it is investing over £3 million every day to maintain, upgrade and renew trains, stations, signaling, track, tunnels and bridges of nine Underground lines, including the City's oldest sub-surface Metropolitan, Circle and District lines and the 74 km long Central line.

Maintenance is a challenge in the narrow Victorian tunnels still in use today. And the overall figures are impressive: 347 trains,

750 km of track, 155 stations, 187 escalators, 125 km of deep tube tunnels, and many other "hidden" assets that have to be maintained by Metronet and gradually replaced by new equipment, while being kept in operation.

"Infrared was introduced at London Underground for fault-finding in signal rooms some 12 years ago", says Joe Nolan, one of the managers of the Metronet Technical Services. "It was an accepted maintenance method", he recalls. Now, Metronet uses infrared cameras for a very diverse range of applications, from dynamic surveys of the infrastructure to lab environment inspections of selected parts and components.



surveying traction supply: defective jumper



surveying traction supply: defective ceramic insulator

# FLIR



### A/V for rail industry condition monitoring includes infrared

Infrared thermography is consistently used by Metronet's Audio Video Inspection (AVI) service. This independent team gathers dynamic visual and infrared video images together with other relevant measurement data for both investigative and routine condition monitoring. Its applications include inspection of tracks and line side components such as signaling systems, the observation of dynamic behavior of wheel and rail and other rolling stock parts, and the train's traction supply; in the UK, trains often take power from an additional third rail or, as in the case of the London Underground, a fourth rail instead of overhead cables. The Metronet team has worked out complete AVI programs and, as a profit and expertise center, offers them to other railway companies.

FLIR Systems ThermaCAM S60 cameras are installed on top of the trains, under the train platform, or on the ground at strategic positions in stations (inside the "suicide pit" under the platform, for example for rolling stock inspections). AVI conducts two full rail equipment surveys per line per year. This video data, recorded in real-time, is then viewed by duty engineers. The infrared imagery appears simultaneously and is run through the FLIR Systems Researcher™ software suite. "The infrared data show us all anomalies and hot spots along the tracks," says Salim Mohamed of Metronet's AVI team. "We extract the images, put them with our comments in reports and give them to the heads of the maintenance teams. Meanwhile, we are also working on the software system, in particular on an automatic identification system of defective insulators, as they increase fire risk."

### Monitoring and optimizing rolling stock parts

In addition to these field observations, the infrared cameras are also used to monitor the rolling stock's mechanical parts, in particular the inspection of bearings or axes under heavy operational conditions and heat load.

And the infrared camera operators are often called to the maintenance hall for an urgent thermographic image during service, testing and repair works on the trains.

The many features of the ThermaCAM S-series camera make it suitable for lab inspections of failed or newly installed individual parts, such as gearboxes, on their resistance against heat and heavy loads, as failed vital parts can cause derailments.

The S-series compatibility with the elaborated ThermaCAM Researcher™ software is particularly helpful to trace the required extensive temperature analysis.

Metronet uses the ThermaCAM S60, a predecessor model of the current FLIR Systems P/SC640 handheld camera range, featuring a resolution of 320 x 240 pixels, Video and FireWire outputs and Researcher software compatibility. The cameras used allow a 50/60 Hz real-time digital recording, which allows images to be taken at a driving speed of up to 120 km/h. Metronet's quality standards prescribe an annual calibration of all the four systems.

### Vital contribution to safety and operations

A technical failure can have serious consequences for the backbone transport system of a city of 8 million. And maintenance can only be done at night or on some weekends and holidays. Consequently, early identification of faults is vital to Metronet: tight schedules and a penalty system require the assignment of the best possible equipment and resources. "The partnership of Metronet with Transport for London started 2003", concludes Salim Mohamed, "and we're happy our maintenance reports have got significantly thinner over the years: the fewer the number of sheets in the reports, the better the maintenance, the less PM teams have to be called on to work at night and, of course, the better the tube works."

*Many thanks to Dave Nelson, Regional Sales Manger, FLIR Systems UK for providing contacts and support.*



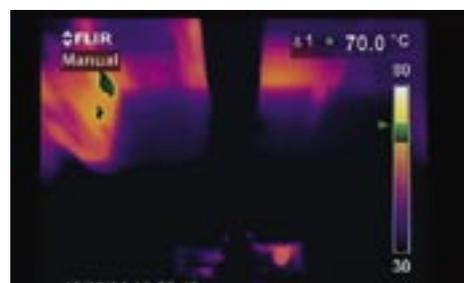
surveying traction supply: defective bond



gearbox monitoring: IR camera setup



gearbox monitoring: ThermaCAM Researcher software screenshot



gearbox monitoring: exceeding the threshold



*Salim Mohamed, Metronet AVI team engineer at Metronet's Main Office's master analysis suite*

For further information contact:

**FLIR SYSTEMS AB**  
 World Wide Thermography Center  
 Rinkebyvägen 19  
 SE-182 11 Danderyd  
 Sweden  
 Tel.: +46 (0)8 753 25 00  
 Fax: +46 (0)8 753 23 64  
 e-mail: sales@flir.se  
 www.flir.com