The use of Thermal Imaging in Transportation Applications
All major industries are seeking to reduce their operating costs while striving at the same time to improve Quality of Service and Customer Satisfaction. The efficient operation of plant and facilities is only achieved by the implementation of effective maintenance management regimes; this is particularly relevant in the transportation industries where manufacturing plant managers have become familiar with the benefits associated with the use of thermal imaging in their maintenance programs.

In the transportation industries, thermography is becoming much more widely applied as the operational advantages, gained from the use of technology become more appreciated. This is true across the board, in vehicles and equipment relating to all transportation modes on land, air, rail and sea.

Predictive/Preventive Maintenance
Over recent years advances in instrumentation technology, and the requirement to reduce operational costs and increase operation efficiency, has resulted in the more progressive industries abandoning traditional routine maintenance programs in favor of condition monitoring and predictive maintenance strategies.

Conventional maintenance programs are driven by equipment failures or by the regular, but often arbitrary 3, 6 or 12 monthly, routine maintenance. Little attempt is made to monitor equipment performance or to track historical maintenance information; little is therefore achieved in terms of minimizing the equipment downtime, extending the useful life of the equipment or reducing the overall lifecycle costs. In part this is due to either the unavailability or affordability of the necessary instrumentation.

The appropriate instruments such as infrared temperature monitors and vibration analyzers are now becoming available. Handheld equipment can be used to simply check the condition of critical equipment; microprocessor based versions of these instruments are increasingly being used to provide continuous condition monitoring. Trend analysis can in many circumstances be more important than for example, a spot absolute temperature measurement. Those organizations employing these strategies are already reporting dramatic reductions in operational downtime and costs, and as a result are predicting increased capacity, improved quality of service and increased returns on investment.

Transportation Applications
Thermal Imaging is a technique for creating an image of a scene based on the invisible thermal radiation emitted from an object. This technology readily lends itself to detecting electrical or mechanical faults in a manufacturing plant, but it is equally appropriate for the identification and measurement of anomalous temperatures in operational equipment – an essential requirement for the transportation organization.

Examples of these applications are:

Marine
The thermal imager is now an important tool for the surveyor (for insurance and damage surveys etc) and the owner/operator alike. Moisture ingress and delaminations in the structure of the vessel can be identified, as can overheating elements in the electrical, mechanical and power generating systems.

Over 60% of all engine room fires are initiated by oil leakage/hot spots. It is therefore important that all surfaces are kept at less than 220°C at all times if risk of auto ignition of oil is to be avoided. Thermal imaging equipment is also used to assist:

1. navigation in night time
2. poor visibility situations
3. collision avoidance
4. man overboard procedures

Automotive/Road Transport
In addition to the well publicized but as yet not universally established night driving systems, enabling drivers to detect potential hazards earlier in poor visibility, there are a number of more widely accepted applications.

Thermal imagers are being used to optimize the performance of brake and engine systems for trucks, cars and buses; in motor racing, the ability to record temperatures in seconds is proving invaluable in the analysis of tire, suspension and fuel systems for diagnostic purposes.

Systems based on thermal imaging are also emerging for use in collision avoidance systems (e.g. for pedestrian detection) and to locate the position of a passenger for effective and safe airbag deployment.

Aviation/Aerospace
The structure of an aircraft is such that there are a number of ways in which thermal imaging is applied for non-destructive monitoring and diagnosis purposes.

Thermography is now used routinely to locate and identify stress cracks and corrosion, to locate delamination of composite materials, to detect water ingress into control surfaces and to diagnose sub- surface icing; it is also used for conventional maintenance applications:

1. tires
2. brakes
3. engine systems diagnosis

It is also particularly useful for the rapid analysis of large areas. Thermal imagers are used in airborne applications such as search and rescue, pipeline inspection and fire mapping.

Railways/Underground networks/Tramways
Any inspection or monitoring process requires temperature measurement, and is better performed by non-contact means; there are many applications for thermal imaging in the railway environment. Consequently the inspection of switchgear, traction and signaling circuits, wheels, tires, and carriage heating equipment is routinely carried out using thermal imaging.

Specific rail related applications include line side or on-vehicle detection of overheating axle boxes, a failed axle bearing creates a serious hazard which can jeopardize the safe operation of the railway, measurement of spatial variation in rail temperatures to avoid track overheating, detection of hotspots in overhead

cables and inspection of pantographs (device that collects electric current from overhead lines for electric trains or trams).

Thermal imaging is also used in tunnel systems to check for example for water ingress through walls and drainage problems.

Thermography
Infrared thermography is one of the most important sensing technologies to be applied to the detection and monitoring of manufacturing and production equipment. Until recently this sophisticated technology was prohibitively expensive, being driven primarily by military applications; over the last few years, however, the technology has improved and it has been introduced to high volume commercial and professional applications by innovative companies such as Wahl. This has bought the price down to a level, which is opening up a host of new applications.

Thermal imagers measure the infrared energy emitted by surfaces remotely and are consequently extremely simple to operate as no physical contact is necessary. Many facilities have employed thermographers to carry out inspections every 6 or 12 months; the cost of the equipment and its ease of use mean that these inspections can now be carried out as and when required by the organizations own maintenance staff. Appropriate thermal imagers no longer need to cost $45,000 or more; for example the comprehensive range of imagers from Wahl starts from less than $2,500 – less than the cost of a single survey from a thermographer.