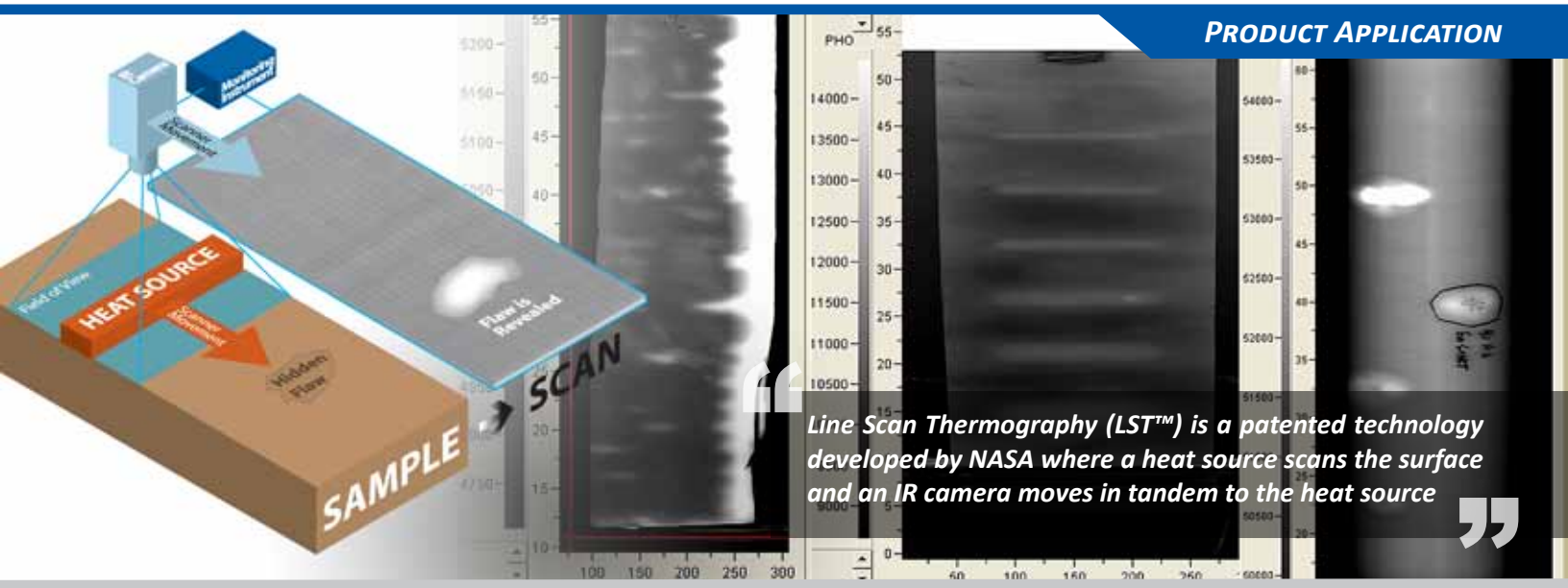
MISTRAS
A World of NDT Solutions
Products & Systems Division

PRODUCT APPLICATION



Line Scan Thermography (LST™) is a patented technology developed by NASA where a heat source scans the surface and an IR camera moves in tandem to the heat source

Thermography Inspection Technique

Portable LST™

Gantry Configuration LST™

LST™ Scanning Cart

LINE SCANNING THERMOGRAPHY LST™

The LST™ in a non-contact inspection method based on dynamic thermography. LST™ has been previously used for thickness determination of boiler tubes; and it is now being applied to composite inspection. The dynamic heat application allows observation of subsurface defects, such as cracks, delaminations, moisture ingress, impact damage, and heat damage among others.

Given the novel heat application and image generation procedures, LST™ lends itself for inspection of large areas; this technique produces a real time digital image of the section inspected, and it is easily implemented both in the field and in different manufacturing processes, making it easier to deploy than other thermography techniques better suited for laboratory analysis.

TYPES OF INDICATIONS DETECTED

- Delaminations
- Voids
- Corrosion
- Wall Thinning
- Paint Adhesion
- Moisture Ingress
- Skin to Core Disbonds
- Porosity
- Wall Thickness
- Fiber Orientation
- Impact Damage
- Contamination
- Spot Weld Inspection
- Paint Thickness
- Coating Thickness
- Adhesive Bonding
- Crack Detection

GANTRY

The LST™ can be mechanized to attach to a gantry or existing scanner that provides one axis of motion. Custom scanners can also be provided to meet your requirements.

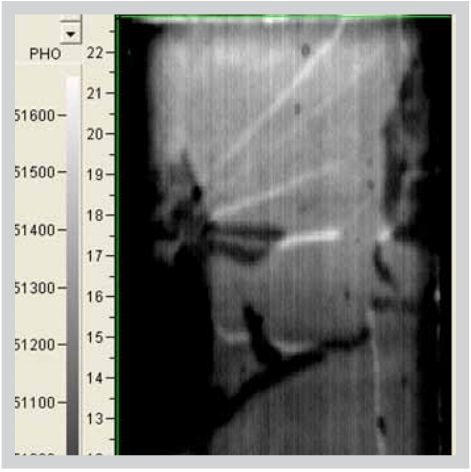
PORTABLE SCANNER

This light and portable scanner is equipped with an active suction cup enabling attachment to flat and slightly curved surfaces, like a composite fuselage. Adapted with magnetic wheels to attach to metallic surfaces like boiler tubes, the scanner has stepper motor driven axis to move the camera and heat source over the test object.

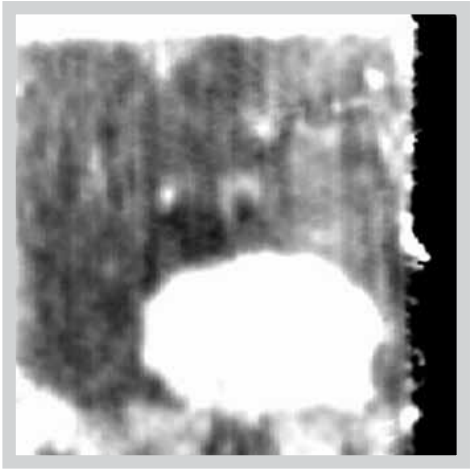
Advantages of LST™

- Lateral motion provides heating uniformity and allows image processing capabilities that improve distinction among defect region, image noise and sound area.
- LST™ is capable of large scale inspection without loss of resolution.
- The image reconstruction procedure provides an intentional in-plane variation in heat deposition that can be used to analyze material with directional properties.

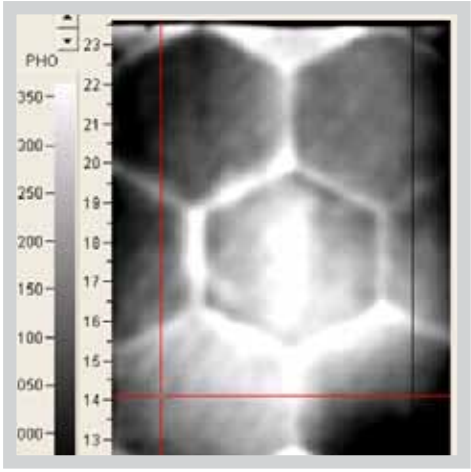
Thermography Inspection Technique



LST™ detects delaminations between skin and honeycomb and the presence of humidity ingress.



Delamination between a 3mm thick fiber reinforced composite and a concrete substrate.



Light armor sample with a fracture in the ceramic tile

LST™ SCANNING CART

Designed to travel over flat surfaces, like a composite deck plating of a ship, to thermographically inspect for imperfections. The system has driven wheels to deliver continuous rolling scans of the deck.

INSPECTION TECHNIQUE

Line Scanning Thermography (LST™) is a dynamic thermography technique that has been successfully used for detecting regional alterations in the thermal properties of the material inspected. As any other thermography technique relying on dynamic heat diffusion, the presence of an interface or any defects affecting heat diffusion will be observed by a regional and temporal change in the surface temperature.

INSPECTION DESCRIPTION

In LST™, a line heat source of finite width moves across the sample's surface at a constant speed, depositing energy into the material. An infrared detector, moving in tandem with the heat source, records the surface temperature changes in the area scanned after heat deposition.

The IR detector's field of view is set to observe only a section of the surface studied. Every frame recorded as the heat source moves through the area scanned is used to generate a thermal image of the whole area scanned. In a single scan, a series of thermal images of the whole area scanned can be generated at different times after heat deposition. This provides the thermal history of the surface studied, as expected in a dynamic thermography technique.

In LST™, the observation times after heat deposition obtained in a scan are dictated by the scan speed, the frame rate of the imager and the thermal properties of the material scanned, such as thermal conductivity, heat capacity, density, and thermal diffusivity. In LST™ the scanning velocity, as well as heat deposition intensity needs to be optimized, given the thermal properties, layer configuration and thicknesses of the materials scanned.

APPLICATIONS OF LST™

The LST™ technique has been applied to inspect composites and a variety of materials such as fiber reinforced composites of materials like fiber glass, Kevlar, and carbon; and in general materials and interfaces that will react to thermal excitation evaluation. LST™ has been used to inspect impact damage in different composite types such as composite tubes and light armor. LST™ has been used successfully to determine thickness of boiler tubes; the technology has also been applied to inspect metallic plates or shells.

During the inspection, a reduction in the thickness is observed as a hot spot in the surface and the increase in temperature is associated to a thickness measurement. One of the more recent applications of LST™ is for the inspection of wind turbine blades, where we are working towards using LST™ to assess the bond quality in the trailing edge, leading edge and the spar/shell joint of the blades.

SUMMARY

The LST™ technique has been used successfully for NDT of laminate composites of different thicknesses, and honeycomb structures with composite skin among other materials.

LST™ provides a technique to inspect large areas in a short time, due to the novel scanning protocols and image processing, and the scanning protocol is able to display continuous real-time images of the areas scanned.

The success of LST™ depends on proper optimization of the scanning parameters, but the simplicity of the technique and the apparatus provides significant freedom for inspection of various structures.

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