
Stockton
Infrared Thermographic Services
IR Thermal Mapping
AITSCAN
Thermal MapIR™

General Specifications

• Aerial IR survey will be conducted at night at altitudes of 3000' - 3500' AGL.
• The imagery collected will be compiled into ortho-rectified geoTIFF image (2ft. GRE)
• A DVD-ROM containing all project files will be provided.

Using the image data, we will be able to point out leaks into creeks, areas of steam leaks and thermal losses and the general condition of all roofs in the area flown. You will then be able to qualify which roofs need work and which do not. Then, we can go back to specific roofs and provide the base personnel with 6" GRE (Ground Resolution Element) imagery, drawings, etc. on just those roofs or other areas of interest.

The mapping system consists of a thermal array fixed mounted into the aircraft cabin. There is an IMU (inertial measurement unit) that records all aircraft movement at 400 times per second. This provides the "geographic-long-lat" orientation-solution trajectory for the imagery. This Inertial Reference Gyro System is tightly-coupled to a real-time Differential GPS Satellite positioning system that provides 0.6m x, y, z positioning to the aircraft at all times. This also eliminates the need for GPS ground stations to resolve final Imagery Geometry Solution.

SAMPLE TECHNICAL OVERVIEW

The flight parameters

Aircraft:	**Twin engine, fixed wing aircraft**
Flight-time Endurance:	5.2hrs
Pilot Navigation:	Garmin-PICDAS with real-time flight display
Flight Altitude:	(~2800' AGL - thermal)
Flight Speed:	120mph (thermal)
Line Swath:	(1515' wide thermal)
Image pixel dimension:	(0.6m thermal)
Line Spacing:	(25% sidelap thermal)

Thermal Sensor:	**Mitsubishi IR_M700 FPA (digital) focal plane array**
Detector:	PtSi Schottky-Barrier FPA
Lens Focal length:	25mm
Field of View (FOV):	30 degrees
Pixel Array(s):	(801(H) x 512(V)
Spectral bands:	1.2um to 5.9um and/or 4.0um to 5.9um
Cooling type:	Sterling cycle
Operating temp:	-10C to +50C
Temperature Sensitivity:	NETD (0.08 C)

Image Time tagging:	**DGPS 1PPS to Matrox Digital Interface**
Navigation 3D-Geometry:	Litton LN200 IMU (Inertial Measurement Unit)
Orientation Data Rate:	400htz (pos, Lat. Long, Elevation, Roll, Pitch, Heading)
Time Tag Accuracy:	0.002sec
Image Frame Rate:	1 frame every 2 seconds (thermal)
Image Frame Rate:	1 frame every 8 seconds (color)
Imagery collected:	3060 thermal images
Line miles collected:	550mi.total
Area Covered:	(~30,000 acres)

Sample Area of IR Thermal Map Survey

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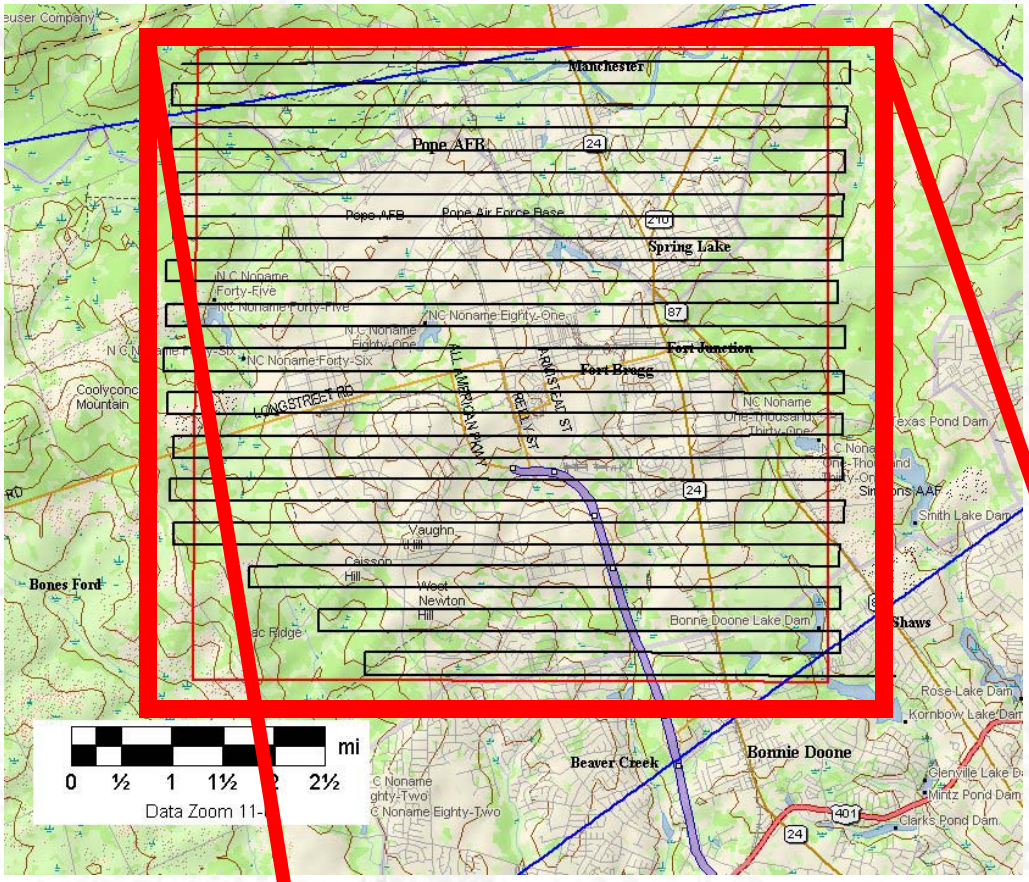

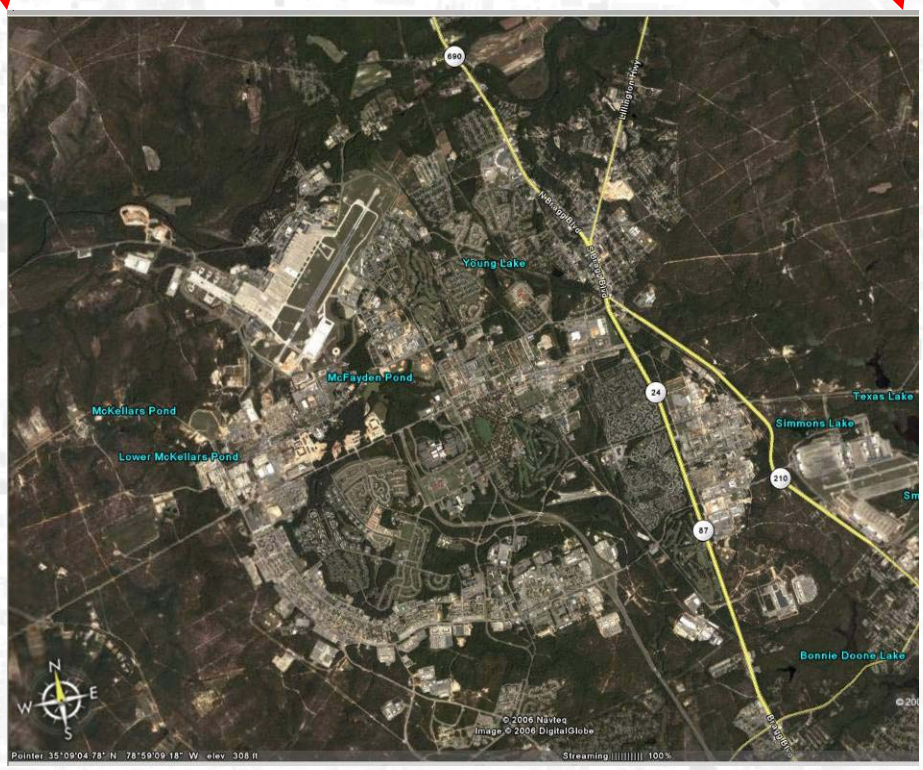

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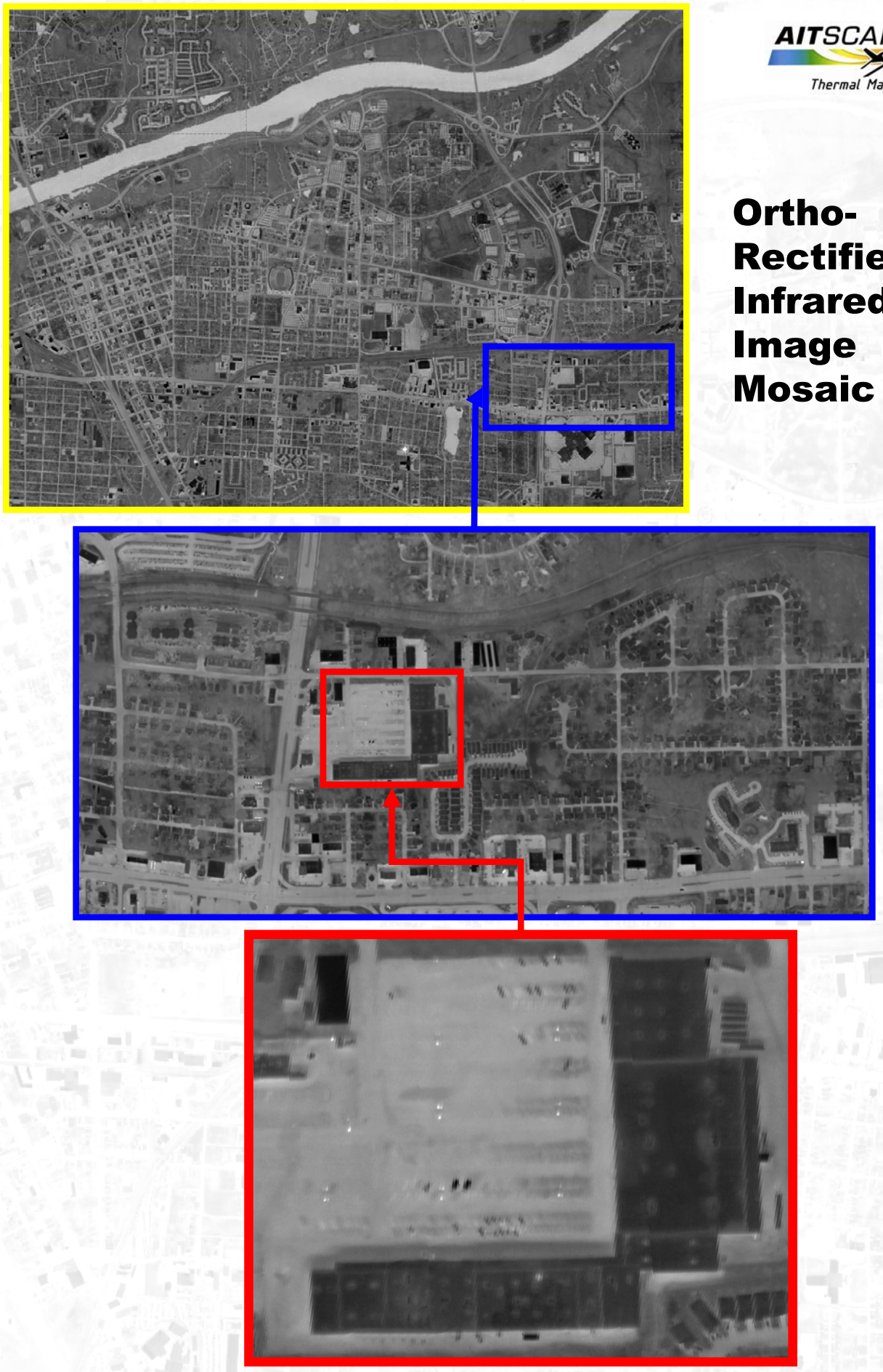
Ortho-Rectified Infrared Image Mosaic



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Three uses for the Infrared Map Data

(Examples and Explanations for each of the three are found on the following pages)

A) Steam Leak Surveying
B) Roof Moisture Surveying
C) Liquid Leak Surveying of Water Utilities

Aerial Infrared In General

Thermal infrared (IR) imagery is imagery that shows heat. It is often in the form of a grayscale picture whose shades of gray indicate the differences in temperature and emissivity of objects in the image.

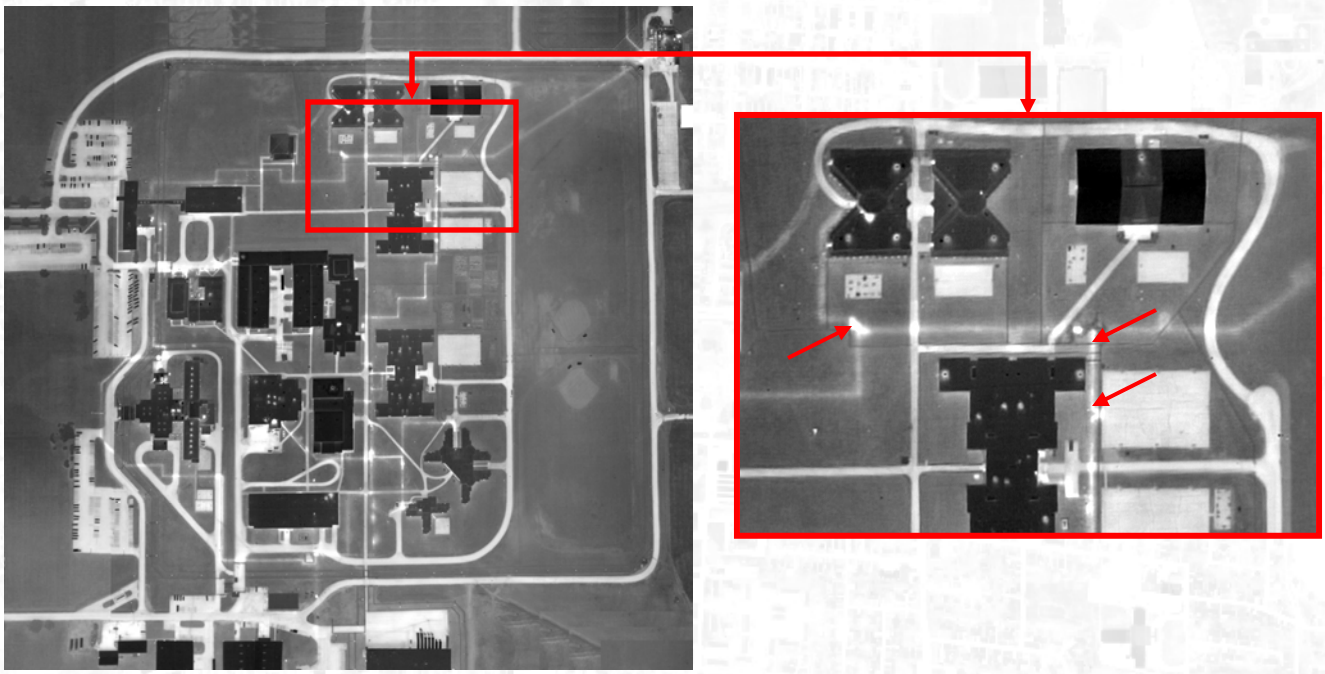
Typically, objects in the image that look lighter are warmer and those that look darker are cooler. Bright white objects are the warmest in the images. Black objects are the coolest. Any object with a temperature above absolute zero (0 Kelvin or –273 degrees Celsius) emits infrared radiation. An infrared picture only shows objects which emit infrared wavelengths in the 3000-5000 nanometer range. Objects in visible light wavelengths of 400 to 700 nanometers are detected, but only because they also emit heat. An example of this would be a warm street light that can be seen in the IR imagery.

We record infrared imagery on digital media and may later copy it to a DVD-Video, videotape and/or capture digital image files. The images may then be modified in a number of ways to enhance their value to the end user, such as creating a false-color image or adjusting the brightness and contrast of a grayscale image to be used in a report.

A) Steam Leak Surveying

Underground steam lines are almost always readily visible with infrared imaging, even when no notable problems exist. This is due to the fact that no matter how good the insulation, there is always heat loss from the lines which makes its way to the surface. Problem areas are generally quite evident, having brighter white IR signatures that exceed the norm. Steam line faults normally appear as an overheated line or as a large hotspot in the form of a bulge or balloon along the line. Overheated lines often occur when the steam line is located in a conduit or tunnel. If there is a leak in the line it will heat up the whole conduit with escaping steam. If a steam line is buried directly in the ground with an insulating jacket, a leak will usually saturate the insulation, rendering it largely ineffective and will begin to transfer heat into the ground around the leak, producing the classic bulge or balloon-like hot area straddling the line. Finally, some leaks may show up as an overheated manhole or vault cover. Manholes or vaults that contain steam system control apparatus which are leaking will often heat the covers to warmer than normal temperatures.

Steam line imagery can be a little misleading, unless one understands and interprets the relative brightness and temperature of a given line correctly. A steam line that is the same temperature from one end to the other that passes under different surfaces and materials can exhibit a variety of temperature variations. For example, five different apparent temperatures will result from the same temperature line that runs under a grass-covered field, an asphalt parking lot, a concrete loading dock, a gravel-covered area and bare earth pathway.



B) Roof Moisture Surveying

Areas of **roof moisture contamination** often manifest themselves as warmer (lighter colored) areas that may be nebulous in shape and sometimes mottled in appearance, although they are commonly found in linear or puddle-like shapes. The linear shapes many times follow low areas, drainage routes, roof edges and seams. Puddle-like round or oblong shapes often form around roof penetrations such as mechanical equipment, standpipes, vents and drains. The wet areas are lighter in color because the latent heat (from daylight sunshine) in the trapped water mass is greater than in the dry, functioning insulation or roof substrate. After sunset when the roof structure cools down, wet areas of roof insulation and other materials continue to radiate heat, allowing our sensitive infrared cameras to detect the sources of heat and record them for later analysis.

Advantages of Aerial IR imaging of Roofs:

• High-angle, straight down infrared images, lessen reflections and capture large areas at once, making the imagery easier to analyze and the report less expensive to produce.

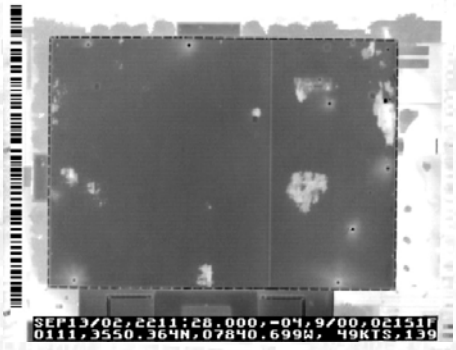
• Since images are captured straight-down or ‘plan view’, the report is clear, concise and easy to understand because infrared images, visual images and AutoCAD® drawings are reconciled.

• Plan view imaging allows for accurate marking of areas of suspect roof moisture contamination. AutoCAD® drawings are made by drawing ‘over’ the captured visual and infrared image on the screen. The infrared, visual and AutoCAD® components can then be separated. If dimensional information is available, this creates a quantitative, scaled AutoCAD® drawing of the suspect roof moisture contamination on the roof. If dimensional information is not available, the drawings become scalable and easily updated at any time in the future once quantitative data is obtained.

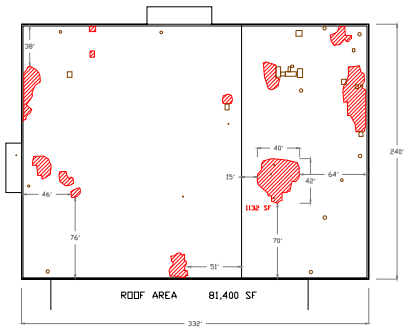
• Access to the facility and to multiple levels of the roof is never a problem.

• The printed AutoCAD® drawings can be used on the roof to paint areas of moisture contamination directly on the roof, if desired.

Photograph



Thermograph



CAD Drawing

C) Liquid Leak Surveying of Water Utilities

Leaking sewage collector lines, storm water drain discharges, water main breaks and taps into storm water drainage lines can often be identified by their thermal infrared signatures during certain times of the year. As these sources of pollution leak, seep or empty into creeks, streams, rivers and lakes, their thermal signatures vary from their surroundings and they can be pinpointed accurately from the air. Cool temperatures (lower than 40 degrees F) and dry (no rain in the last 48 hours) conditions are required. As a general rule, the lower the ground surface and the water surface temperatures, the more contrasting the image.

A given area of any waterway will exhibit near homogenous temperature patterns except for areas where another liquid has joined the flow. This flow of liquid typically appears warm as compared to the surface water in a creek, stream, river or lake - particularly during cooler times of the year, due to the relative warmth of the ground a short distance below the surface. **Leaks from nearby lines often come to the surface through lateral transfer to a creek, stream, river or lake bed, or to a slope leading down to the surface of the water.** These leak areas and the warm plume of liquid joining and flowing downstream with the body of water are visible in the thermal infrared spectrum due to the difference in temperatures of the two liquids. Late fall, winter and early spring are well suited to this type of inspection because of the cooler water temperatures (ground and surface waters) and because the interference to view by foliage is minimized. Ground water seeps and outfalls of all types are also easily distinguishable for similar reasons.

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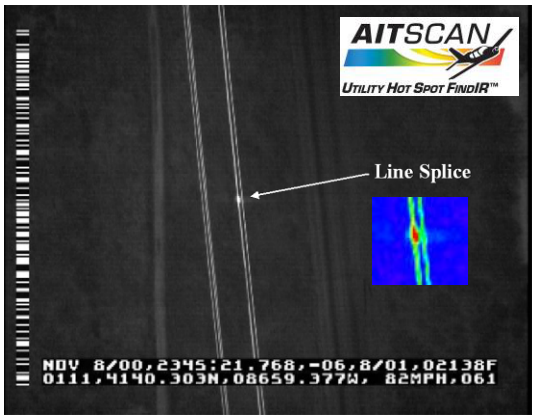
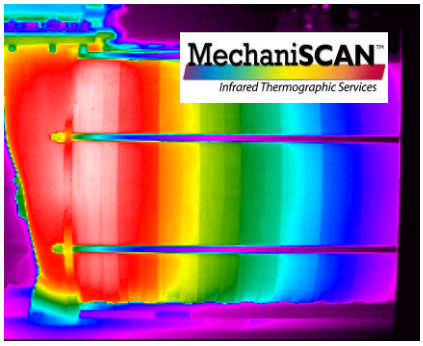
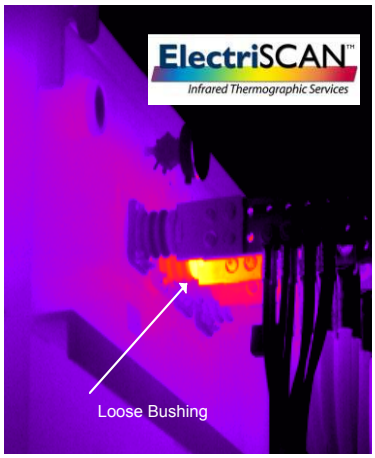


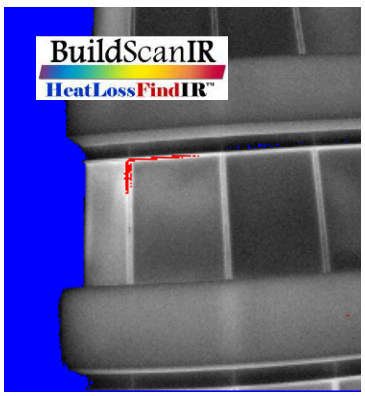
Aerial Electrical Infrared on Transmission Lines



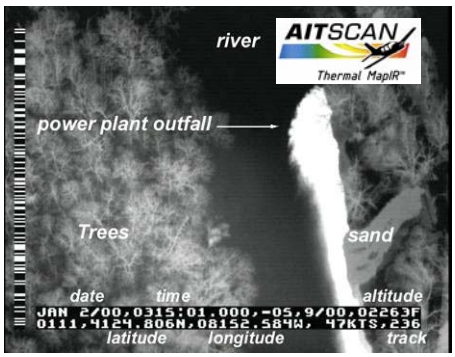
Mechanical Equipment IR P/PM



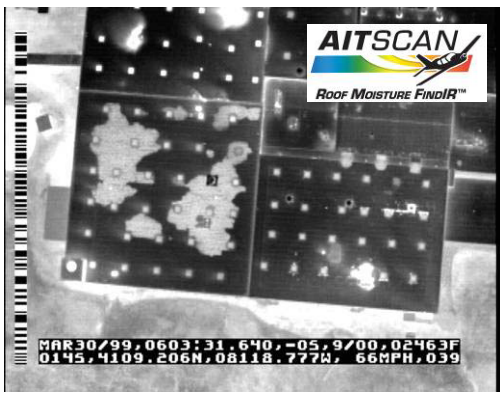
Electrical Equipment IR P/PM



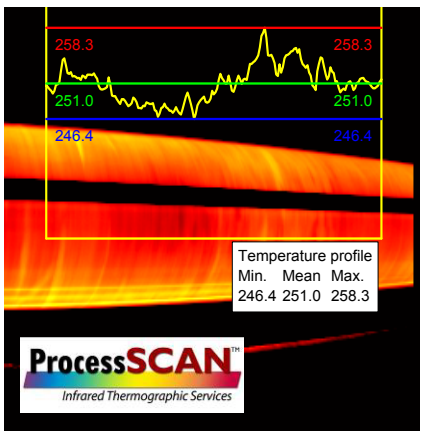
Building Heat Loss Surveys



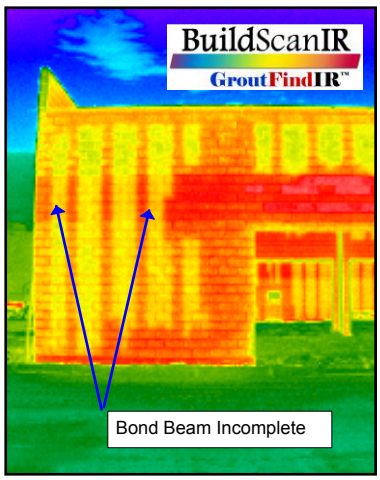
Environmental Impact Surveys



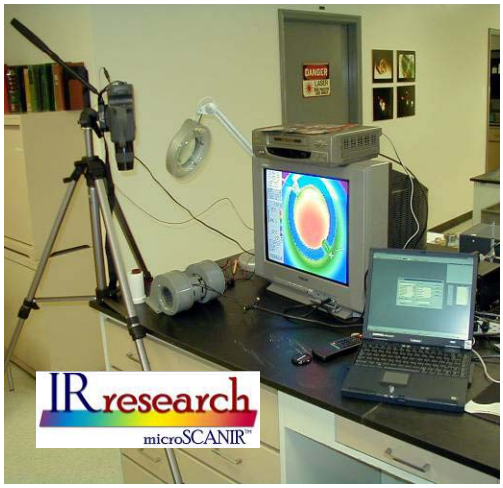
Aerial Infrared Roof Moisture Surveys



Industrial Process Monitoring



Structural Analysis



Typical R&D test set-up

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