Think Thermally®

Practical news for practicing thermographers

December 2003

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Thermal Solutions®: The Conference

Bringing experts and practitioners together in a stimulating and friendly learning environment

Practicing and aspiring thermographers are bound to reap numerous benefits by attending the 6th annual offering of Thermal Solutions®, January 26–29 in Clearwater Beach, Florida. Regardless of the equipment you use, how much experience you have or where you do your work, Thermal Solutions® 2004 "has something for everyone from the beginner to the level III thermographer and above." This, from past participant Alan Duggins, of Edison Mission, O&M.

The core of this year's conference is more than two dozen presentations by industry professionals that cover a variety of predictive maintenance applications. Attendees will witness proven techniques and learn from intriguing case histories that will ultimately enhance their work. Keynote speakers for Thermal Solutions® 2004 include Cliff Warren, a respected infrared industry veteran as well as an accomplished Olympic Marathoner and an Emmy-Award winning Meteorologist. A copy of the conference proceedings is given to all participants in both print and on CD-ROM.

Benefits to participants include:

- knowledge of new techniques
- information on how to refine your practice
- ways to move theories to applications
- approaches to saving your company time and money
- cutting-edge information and applications
- opportunities to interact and learn from experts and colleagues
- the chance to grow in your discipline
- improving personal marketability

One of the most popular aspects of the conference remains the short course offerings, available on Monday, January 26th. Topics this year include Establishing a Certification Program, Inspecting Mechanical Equipment, Inspecting Buildings, Electrical Inspections and Certification Testing based on ASNT SNT-TC-1A. On Monday afternoon, those that qualify and have their own camera may enroll in an ASNT-based certification testing session administered by Snell Infrared trainers who hold an ASNT NDT Level III certificate.

At the Thermal Solutions® 2004 Exhibit Hall, participants have the chance to interact with representatives from a variety of industry organizations. Snell Infrared, while vendor-neutral, maintains close working relationships with the wide array of camera manufacturers, publishers and service companies from around the predictive maintenance industry.

If you are looking to enhance your role as part of a growing community of thermographers, plan on attending Thermal Solutions® 2004. For more information, including a listing of paper presentations, short courses and vendor exhibits, please visit the conference web site at www.thermalsolutions.org or call Snell Infrared directly at 800-636-9820.

Find out more about this year's special incentive when you ***Bring Your Boss to Thermal Solutions.***

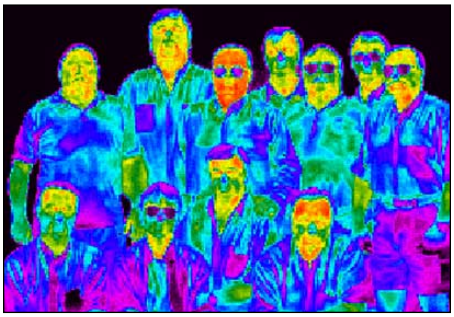
For details, call

800-636-9820

Is *your* infrared program a success?

What does success look like?

In *Surveying the elements of successful infrared predictive maintenance programs** John Snell explored those very questions. He created a summary of data from years of training work. The intent of this article was not so much to define success, but to paint a picture of a successful program. He wanted to find and describe common elements in infrared programs which participants themselves had described as successful.



Among those elements were education, synergy, protocol, reports and qualification. Here is an abbreviated description of all the elements of success; maybe you can use this as a guide for looking at your program.

Investment is required. These include investments of management, technology and personnel. Management must define the needs and scope of the program and develop management tools. Typically, those tools include time lines, justification and evaluation. The technology and personnel for inspection must be provided via contract or procurement. Management will have to establish communication in the program.

Just getting started is a major contribution to success. Finding a way to introduce one inspection or to bring a camera in can kick off the entire program. Many companies start with just one application, or even just one type of inspection. Sometimes a consultant is brought in or resources from a sister plant are employed as a beginning. Introducing and proving the technology paves the way to expand the program.

*A paper published for Thermosense in 1991.

Education is key. Successful programs educate throughout the organization. Infrared is such a visual medium; this technology provides perfect opportunities to show others what is happening. In-house newsletters, presentations for management and posting your findings on bulletin boards are all excellent ways to communicate success.

People make the program. Giving thermographers a sense of ownership and empowerment is important. Many new programs do not have full-time thermographers; giving support and latitude in creating a way for them to work can be beneficial. A one-person program is vulnerable. Involve people from various levels and departments within the organization.

Synergy: Merging infrared with other PM technologies can be powerful. Most frequently, infrared is teamed with vibration, ultrasound and MCE. These methods share similar management strategies and report formats.

Develop standard operating procedures to provide a consistent means of conducting inspections and reviewing results. Determining opportunities and frequencies is also important. For example, inspecting newly-installed equipment has proven to be an important strategy, as is inspecting prior to a shutdown. Finally, the thermographer(s) and the client must establish how they will communicate any issues that may arise before inspection or after repair.

Establishing routes and frequencies can best be done by bringing together equipment histories and knowledgeable personnel. From that meeting, a list will result. This list should describe what will be inspected and the schedule for doing so. The first inspections will probably reveal many "finds," while subsequent inspections will be both more thorough and more efficient.

Reports are vital, and should be made simple. Reporting software today has made the job easy, and storing information electronically is most often the best, effective tool.

Training and qualification are essential. Initially, training will serve to de-mystify the technology and to introduce the thermographer to the method. We have seen established programs brought alive with more training. Experience shows that a reasonably conscientious, motivated maintenance technician with a few years experience in their trade makes an excellent thermographer. Assessment of performance helps to assure that the thermographer is qualified. Successful programs build training and qualification into their management plans and practices.

Based on all of that, how successful would you say your program is? As you read the list do you find yourself feeling familiar with these elements, or wanting these things? Does the list help you to define where there are gaps in your program? And, can any of the gaps be filled with some of the offerings at our Thermal Solutions® Conference?

Prior to the Monday evening opening, attendees will have six opportunities to explore a variety of topics. Thermal Solutions® is offering six three-hour short courses, each designed to give your program the shot in the arm it needs. This year's courses include: *Establishing a Certification Program, Inspecting Mechanical Equipment, Inspecting Buildings, Electrical Inspections* and *Certification Testing based on ASNT SNT-TC-1A.* Whether you are trying to start with a single camera and a single inspection or whether your program is started and you are trying to strengthen it, Thermal Solutions® provides a beneficial educational opportunity.

If you would like a copy of the paper outlined in this article, just e-mail Diana Wright at dwright@snellinfrared.com or call 800-636-9820. Your success matters to us!

Summaries of Some Recent Thermal Solutions® Papers

Thermal Solutions® 2004 participants can take in over two dozen presentations that cover everything from innovative inspection techniques to advancements in technology. Many of these presentations are developed from the personal discoveries and experiences of other thermographers. It is Thermal Solutions® that provides them with the necessary platform to share their efforts with other predictive maintenance professionals. The following paper summaries, presented at previous conferences, offers those involved in the Thermal Solutions® experience the chance to learn from the work of others in our infrared community.

Predictive maintenance integration at the *New York Times*

James Sullivan Jr., The New York Times
Proceedings of Thermal Solutions® 2002

The newspaper industry is unique not only in its demanding production schedules but in its limited program that can incorporate several of the advanced maintenance technologies.

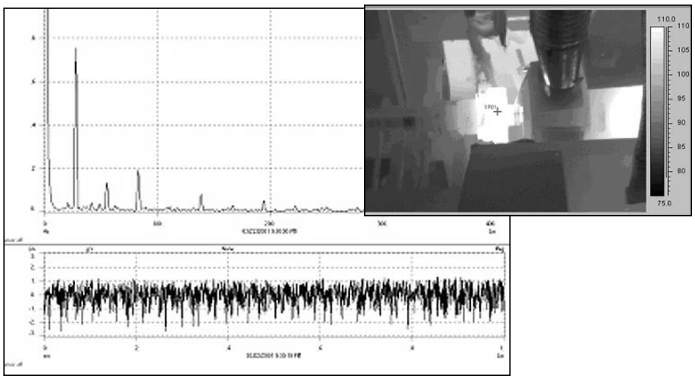
At The *New York Times*, we have found a satisfactory level of PdM integration. The general maintenance personnel will use ultrasound and stroboscopes for suspected problems during a production run. The general maintenance personnel will also collect vibration and oil samples on regularly scheduled PdM tours. Predictive Maintenance Technicians collect diagnostic vibration data and thermographic images.

An example of PdM integration was a line clutch on a press lineshaft. A thermographic scan was done of the entire lineshaft during a live production run. Scans and reporting for a ten-unit press was completed in a matter of 2 hours. One of the problems discovered was a Press 25-07 Line Clutch with a temperature of 168˚F approximately 60% above normal *(see figure above right)*.

Both the vibration data and the thermographic data complimented one another in confirming a definite problem with the line clutch. A priority 2 was assigned and a repair/replace job was requested for the next available maintenance window in accordance with the priority rating.

The maintenance crew reported finding a worn out bearing housing and worn shifter pins on the line clutch. They replaced the whole assembly with a rebuilt unit. The following day another thermographic scan was done and vibration data was collected to verify the repair was done properly and to establish a new baseline in the database.

To have a successful predictive maintenance program you will need to understand the tools available to you and have the practical knowledge to know when to apply each technology. If two or more technologies can point to a fault, the chances of misdiagnosing a problem become less of a threat. By making more accurate diagnoses, you can order your parts more appropriately and schedule your production run time and your maintenance downtime with greater confidence.



Spectrum, Time Waveform and Thermographic Scan of Press 25-07 Line Clutch (Before)

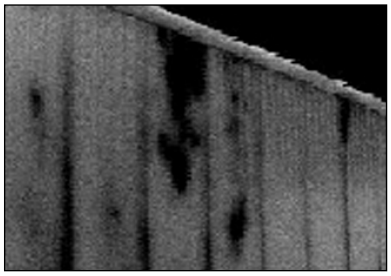
Thermal evaluation of refrigerated facilities

Phillip C. McMullan, TSI Themo-Scan Inspections
Proceedings of Thermal Solutions® 2000

The use of non-destructive testing methods to examine the thermal envelope of low and medium temperature refrigerated facilities is the subject of this paper. Equally important in the refrigeration process are the mechanical refrigeration system components and the thermal envelope of the area being refrigerated. This area defined by the thermal envelope, often referred to as the refrigerated box, is of critical importance.

The use of non-destructive infrared imaging of the refrigerated box provides an invaluable dialogistic tool. The presence of any type of breach in the box can create havoc with the refrigeration system. As the system works to remove latent and sensible heat from the cooler, the uncontrolled addition of ambient air can cause a number of problems including additional energy consumption, product loss and thermal envelope damage.

An infrared thermographic inspection on the exterior walls and ceiling/roof was conducted from the interior and exterior, where possible, of the refrigerator building envelopes. The purpose of this inspection is to document heat loss/gain, as well as other thermal anomalies in the building envelope that might be associated with excessive moisture and/or air infiltration in the walls and ceiling of the facility.



Moisture has penetrated this wall section resulting in excessive conductive losses.

After reviewing the test data it appears that conductive heat gains, excess air infiltration and increased humidity levels are present in these

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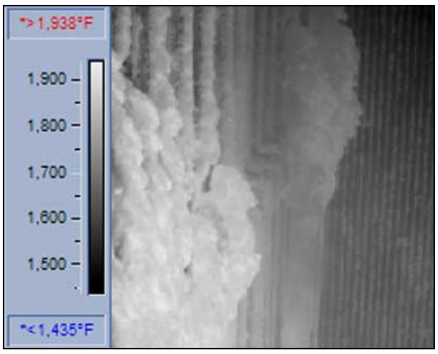
buildings. This situation is making it difficult for the refrigeration units to keep up with the load, and adjustments to these units have already been made in an attempt to overcome this additional heat gain. After uncontrolled air infiltration has been eliminated and moisture damaged insulation has been repaired, the changes that have been made in the refrigeration operation may need to be re-examined for their performance and necessity.

Significant benefits can be achieved in the functional performance of refrigerated spaces with the use of thermal imaging in conjunction with normal refrigerated system maintenance on a routine basis. Potential problems can be identified prior to becoming serious. The result will be lowered maintenance and operating costs for refrigerated facilities.

IR Furnace Inspection In Electric Generating Plants

Gene Jennings, Southern Company
Proceedings of Thermal Solutions® 2003

The utility industry has been faced with a number of challenges in recent years. The integrity of the generating plant and the assessment of the condition of furnace components are more important than ever. Utilizing infrared technology in the inspection of coal-fired, balanced draft furnaces helps electric generating plants reach these goals. IR technology sometimes allows decisions about the unit to be made without shutting down or reducing load.



Slag buildup, as seen in this thermal image, can cause significant problems inside a boiler.

The inspections of the coal-fired furnaces in electric generating plants are now being performed with cooled, FPA-detectors that are sensitive in the short wave length. It is equipped with a 3.9-micron band pass filter, which is also called a flame filter. This camera has a spark shield to protect the front surface of the lens from radiant heat and particles that may come from the furnace. This shield allows for an easy attachment of a deflector to protect the camera and thermographer from the radiant heat of the furnace. The thermographer must also be equipped with proper PPE at all times.

The main issue addressed in IR inspections is the buildup of slag on the furnace components. Slag can be a result of many things such as the fuel being burned and the operating parameters of the furnace. This slag buildup can be detrimental to the life of the furnace and the output of the generating unit. Buildup of slag causes problems with heat distribution across the components. It can also cause structural issues by adding extra weight to the elements as well as damage to the structure if it breaks loose and falls to the furnace bottom. IR inspections can detect slag buildup before it is severe enough to cause these problems.

The IR camera is also an important tool in the removal of the slag. The use of high-pressure water is sometimes used to remove buildup while the furnace is operating, and the IR camera allows the thermographer to see inside the furnace to aim the water directly on the slag, which minimizes the thermal stresses to surrounding components.

Another common problem in a coal-fired furnace is tube leaks. The use of IR can sometimes detect a tube leak. This detection depends on several factors: location, severity, and impingement of the steam on adjacent components. The ability to detect the leak before the unit is shut down allows for a faster turnaround time for the repair.

The use of Infrared technology to inspect coal-fired furnaces has many uses and is mainly restricted by limited access. As with any tool or inspection technique, Infrared may only give part of the answer, but it may be the part needed for the solution.

Use of Thermography to monitor a hot bushing on a 230 kv Main Transformer

Mark Tallon, Progress Energy
Proceedings of Thermal Solutions® 2003

Thermography has been used successfully at the Brunswick Nuclear Plant to find many high resistance connections on high voltage components in transformers and in the switch-yard.

On June 7th, 2000 PM Personnel performed an Infrared Scan of the BNP Unit 1 Main Transformer yard. The 1C Main Transformer exhibited an elevated temperature (~56˚F above the other transformers) at the top of the Main Transformer Main

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Thermal Solutions®: A Networking Community

At Snell Infrared we have found that much of our success in training thousands of thermographers has come from our commitment to develop long term, personalized, relationships with both prospective students and graduates. This philosophy is a driving force behind the Thermal Solutions® experience. It is a belief that all thermographers, regardless of their equipment preference or previous training experience, are welcome as part of a larger infrared community.

Thermal Solutions® is filled with chances for attendees to develop these valuable relationships with others that are active in the industry. Events at this year's conference such as the Monday evening dinner reception and Wednesday evening dinner cruise are just two parts of an experience that contains a multitude of networking opportunities not seen anywhere else in the world of infrared.

Imagine spending your days at Thermal Solutions® surrounded by professionals who share the same interests,

passions and emotions about a technology that is such an important part of their daily lives. Conference attendees are a captive audience who not only listen well, but are supportive of all infrared enthusiasts whether they are a novice or an industry veteran.

Whether on break from the over two dozen paper presentations or during one of the many meals, Thermal Solutions® participants are literally showered with moments of conversation involving thermographers from a variety of industries. Taking advantage of these instances, conference attendees generate enormous potential for themselves by turning simple introductions into career building partnerships.

Successful thermographers today understand this and have discovered the importance of attending Thermal Solutions® to share their interests and experiences. It is from these exchanges that the power of networking can open numerous opportunities for those that are both new and old to thermography. Past Thermal Solutions® attendee Bobby Fogle of the Goddard Space Flight Center has even thanked us for "putting on a conference like this so ideas can be shared and professional connections can be made."

We too feel that those who participate in Thermal Solutions® will experience these same kinds of connections. Join the growing family of thermographers who value personalized attention and objective information by becoming part of the Thermal Solutions® community at this year's conference.

Thermal Solutions® Paper Summaries, *continued from previous page*

bushing. The bushing connection hardware on the 1C Transformer is different from the other 5 main transformers. Increased monitoring over the next 6 days showed the temperature difference increasing to a point where the 1C Transformer bushing connection was 131.9˚F higher than the other 5 transformer bushings on Units 1 & 2.

The Transmission Department was called in to assist with a disposition. Investigation revealed the bushing was disassembled and reassembled during the recent Unit 1 refuel outage. Between Brunswick Engineering and Transmission personnel it was determined that the bolts on the bushing connection could be loose, creating a high resistance connection, and that it would be appropriate to attempt tightening the connection while in service. This decision proved to be correct and the temperature difference was decreased to approximately 58˚F. However, a 58˚F temperature difference is still a condition requiring monitoring. Consequently, the decision was made to continue monitoring the bushing and devise a repair plan for the appropriate opportunity to correct the condition.

Since shutdown of Unit 1 would be required to replace the bushing it was determined that Predictive Maintenance would continue to monitor the bushing temperature closely and Engineering would devise a severity criteria and actions required should the severity criteria be achieved (i.e. power reduction or unit shutdown for repair/replacement). Frequent monitoring (at times daily) of the bushing temperature was conducted by System Engineering, Predictive Maintenance, and BNP Management; from June 2000 until shutdown of Unit 1 for the refuel outage on March 1st, 2002.

The severity criteria, requiring reduction of power or Unit 1 shutdown was never achieved and the bushing was replaced with a new one during the Unit 1 refuel outage.

You can reach *Think Thermally*® at:

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Web Site:
<http://www.snellinfrared.com>

Snell Infrared 2004 Course Schedule

Level I ($1,495)

Phoenix, AZ	February 9–13
Edmonton, AB Canada	February 23–27
Tampa, FL	March 15–19
Indianapolis, IN	May 3–7
Toronto, ON Canada	May 10–14
Minneapolis, MN	June 21–25
Montpelier, VT	August 9–13
Portland, OR	September 13–17
Edmonton, AB Canada	September 13–17
Charlotte, NC	October 4–8
Dallas, TX	November 8–12
Toronto, ON Canada	November 22–26
Montpelier, VT	December 6–10

Thermal Solutions® ($995)
Clearwater Beach, FL
January 26–29, 2004

Level II ($1,495)

Phoenix, AZ	February 9–13
Tampa, FL	March 29–April 2
Edmonton, AB Canada	May 31–June 4
Minneapolis, MN	June 21–25
Montpelier, VT	September 13–17
Dallas, TX	November 8–12
Toronto, ON Canada	Nov. 29–Dec. 3

Level III, Best Practices ($995)

Toronto, ON Canada	June 7–9
Indianapolis, IN	October 19–21

Need a course in Materials Evaluation, Process Monitoring or R&D?

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Custom courses, or any of the courses listed here, can be provided at your facility.

Specialty Courses ($750)*

Mechanical Applications:

Toronto, ON Canada	March 22–23
Charlotte, NC	April 22–23
Phoenix, AZ	Sept. 30–Oct. 1
Edmonton, AB Canada	October 19–20

Electrical Applications:

Charlotte, NC	April 20–21
Toronto, ON Canada	May 18–19
Phoenix, AZ	September 28–29
Edmonton, AB Canada	October 21–22

Building Applications:

Minneapolis, MN	March 30–31
Toronto, ON Canada	December 7–8

* Level I or extensive thermographic experience is a recommended pre-requisite for these two-day Specialty Courses.

Snell Infrared

Training, Certification and Support for Thermographers

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All courses can be presented on-site at your facility... call us for more details!