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August, 2002

INFRAMATION 2002 - LESS THAN 2 MONTHS AWAY!

The InfraMation 2002 conference will be here the end of next month! [Book](#) your flights and hotel room now if you haven't done so. Special travel discounts have been arranged through [Eltiv Travel](#). Call them at 978-667-4849 for details

Click [here](#) to view the latest abstracts (including 8 new ones) of all the papers and check out this year's [special](#) event.

The conference, which will be held September 29 to October 2, 2002 in Orlando, fo-

cus on the development of effective Thermographic Inspection techniques and procedures in a wide variety of Industrial and Research settings. The conference also serves as a user's meeting for all AGEMA, Inframetrics and FLIR camera users.

The InfraMation 2002 conference is sponsored by The Infrared Training Center and FLIR Systems and is held on an annual basis. Registration information can be obtained at www.inframation.org or call 1 800-254-0632 for more information. ♦

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RESULTS OF A PDM PROGRAM IN ITS INFANCY

An ITC customer recently had a rather unnerving experience at their facility (an automotive assembly plant). One of the main buss plugs in the Paint dept. caught fire and caused an evacuation of the plant, resulting well over \$150,000.00 in costs to the company.

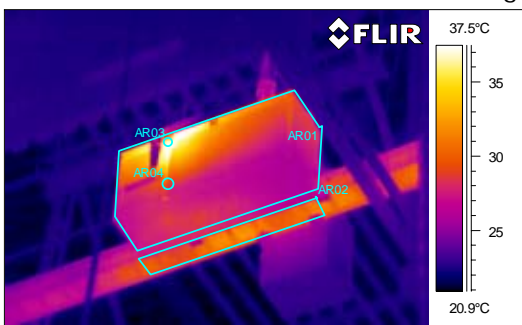
Fortunately there were no personal injuries as a result of this accident, and although the situation could have been much worse, there were some serious concerns raised due to the fact that there are numerous highly explosive materials used throughout the department. The potential existed for a deadly explosion.

The **PreDictive Maintenance Team**, (just in its initial start-up stages) was asked if they had previously performed any plant buss inspections. Their "Five Year" implementation plan included the set-up of semi-annual buss inspection, but, as it was not scheduled for another year, they had not done anything yet.

Due to the serious "Safety" concerns raised by the situation in Paint, they were requested to pull this scheduling ahead, and perform a plant-wide inspection as soon as possible. As the Maintenance Associates on the PDM Team responsible for collecting shop floor data had

(Continued on page 6)

Buss Plug A – Assembly



Delta "T" on outside of box of 8°C from top to bottom.



Delta "T" on inside of box of 33°C between phase "A" and "C".



**YOU ARE CORDIALLY INVITED TO THE THIRD ANNUAL
INFRARED THERMOGRAPHY
APPLICATIONS CONFERENCE
September 29 – October 2, 2002
Orlando, Florida**

The Infrared Training Center (ITC) and FLIR Systems, world leaders in thermography training, thermal imaging and temperature measurement systems, invite you to attend our unique and informative **InfraMation 2002 Applications Conference** – the leading global infrared camera user meeting – in Orlando, **September 29 – October 2**, at the beautiful **Wyndham Orlando Resort**.

InfraMation provides an exciting forum to network with other IR thermographers and technical professionals to exchange applications information and success stories. Most importantly, learn new ways to maximize your investment in IR technology!

Stay current with innovative thermography applications, predictive maintenance trends, cost-saving techniques, and cutting-edge infrared camera and software developments – including the **new ThermoCAM P and E-series systems from FLIR**.

**Register before August 31, 2002 and receive
a value package worth up to \$500!**

Highlights of this exciting 2 ½ day **InfraMation 2002** conference will include:

- Over **30 informative presentations** by actual infrared camera users
- **FREE IR applications and software clinics** – bring your specific work projects, problems and questions for expert consultation. Clinic attendance is limited and you must be a paid **InfraMation 2002** Conference registrant to reserve a spot so register today!
- **Exhibitors Showcase** featuring interactive displays by leading predictive maintenance vendors
- Both informal and formal discussions with fellow thermographers, industry professionals, and ITC instructors.

Early Bird Savings Date Extended!

InfraMation is designed and produced by the world's leading IR experts to help you get the most out of your infrared program. Whether you're a new or seasoned thermographer, **InfraMation** is the one thermography conference you can't afford to miss!

To learn more, visit our web site <http://www.inframation.org/index.aspx>

Register before July 31, 2002 and take advantage of our special discount package!

FOR QUICK AND EASY INFRAMATION 2002 REGISTRATION

Call toll free: **1-800-254-0632** or,

email: inframation@flir.com, or,

register on line: <https://www.inframation.org/secure/secregistration.aspx>

[Wyndham Orlando Resort](#)



See the abstracts on page 4



Infrared Thermography

Regional Level I certification courses

The Infrared Training Center is holding a series of infrared training courses and would like to invite you to attend! The Level I course is geared to the new IR camera user and focuses on its use for a variety of applications. Attendees completing course requirements and a field assignment will receive a Level I Thermography Certification.

COURSE HIGHLIGHTS

- *Introduction to thermal imaging and measurement systems for predictive maintenance applications. No experience in thermography is necessary!*
- *Collect quality data, accurate temperature readings, and account for measurement effects such as distance and emissivity using IR cameras.*
- *Interpret thermograms and make informed decisions using heat transfer concepts to analyze images, and see the latest in report generation and database software.*
- *Avoid costly mistakes — distinguish between hot spots and reflections, direct vs. indirect readings and qualitative vs. quantitative thermography.*

TUITION

A registration fee of \$1550 includes 4-day seminar cost, breakfast/lunch and all course materials.

REGISTRATION

If you have any questions or to register, please contact Laurie Kelley:
(978) 901-8291 or toll free at 1-866 TRAINIR.

1-866 TRAINIR

<http://www.infraredtraining.com/>

SAN FRANCISCO

DATE: Aug. 13-16, 2002
 TIME: 8 A.M. to 5 P.M.
 WHERE: PG&E Learning Center
 3301 Crow Canyon Road
 San Ramon, CA 94583
 Phone: 925-866-7500

Hotel info: http://itcnewsletter.com/mpc/docs/Site/Reg_Courses.html
 Visit this link for directions and travel information:
http://www.pge.com/009_about/009c1_san_ramon.shtml



HAWAII

DATE: August 19-22, 2002
 TIME: 8 A.M. to 5 P.M.
 WHERE: Hawaiian Electric Company
 Waiau Power Plant
 475 Kamehameha Highway
 Pearl City, HI 96782
 CONTACT: John Itai
 PHONE: (808) 543-4231

HOTELS:

The Best Western Plaza Hotel
 3253 North Nimitz Highway
 Honolulu, HI 96819
 Phone: (808) 836-3636
 Rates: \$93-\$136 + tax

Pagoda Hotel
 1525 Rycroft St.
 Honolulu, HI 96819
 Phone: (800) 941-6611
 Rates: \$70-\$170 + tax

Ala Moana Hotel
 410 Atkinson Drive
 Honolulu, HI 96814
 Phone: (808) 955-0108
 Rates: \$89-\$200 + tax



Explore Hawaii's natural beauty as you learn about infrared

INFRAMATION 2002 ABSTRACT SUMMARIES

Infrared applications in the petrochemical refinery*Robert Bonin, Motiva, Inc., Port Arthur, Texas*

IR Thermography is used as a relatively new and highly successful predictive tool in the Motiva Refineries. This paper discusses how new potential applications are explored and evaluated. Particular focus is on the determination of cost avoidance potential for each application.

Thermographic evaluation of trapped liquid*E. M. Crisman, Duke Engineering & Services, Huntersville, NC*

The director of materials & metallurgy lab describes his IR thermographic response to an engineering requirement to identify trapped liquid in out of service steam generator tubes. The successful technique described is based on his previous work on the Titan booster second stage fuel and oxidizer tanks.

Don't let the RAT bite you!*Mikael Cronholm, FLIR Systems, Sweden*

This thermographer/scientist explores some of the misunderstandings that thermographers have encountered regarding "reflected apparent temperature" (RAT), and sets them straight. He then gives you a good look at what could happen to your results if you let the RAT bite you.

Highly reflective materials and their effect on electrical thermographic surveys*Joe DeMonte, ITC, Boston*

This paper deals with the problem of inspecting low emissivity surfaces on electrical equipment—how highly reflective materials affect a thermographer's ability to find minor temperature rises—and what you can do about it.

Thermography in diagnosing and predicting horse injuries*Hesham Fattouh, FLIR Systems, Egypt*

The use of thermography as a predictive medicine tool is explored in this paper. It describes how periodic scanning of a horse provides the opportunity to study different trends in body temperature and to predict and treat injuries before they lead to serious problems.

NEW - The use of infrared thermal imaging to identify gas hydrate in sediment cores*Kathryn Ford, Graduate School of Oceanography, University of Rhode Island*

The dissociation of gas hydrate in sediment cores is an endothermic process, so sediment containing hydrate is characteristically colder than the surrounding sediment. This paper explores the potential of IR thermography to the

analysis of marine sediment deposits.

Thermography shielding effects of bushing covers on breaker bushings*Jerry Frank, Florida Power and Light Company*

What effect do breaker bushing covers or animal guards have on thermography results? Can the thermographer get true results, or do the covers mask high temperatures associated with an impending failure? This paper provides some surprising answers.

Keys to a good inspection program*Mark B. Goff, P.E., Tennessee Valley Authority, Chattanooga Tennessee*

A seasoned predictive maintenance thermographer reviews the PdM thermography program used in substations at Tennessee Valley Authority (TVA) and how, through a clear understanding the key elements of their program, other industries can benefit from the same approach.

How ultrasound and infrared work together to enhance leak inspection*Mark Goodman, UE Systems, Inc., Elmsford, New York*

An ultrasound expert, investigates the union of infrared and ultrasound diagnostics for generic pressure and vacuum leaks; steam trap and valve leak inspection; heat exchanger and condenser leaks and air infiltration leaks.

Integrating infrared and airborne ultrasound*James M. Hall, SDT North America Ltd., Woodstock, Georgia*

This paper demonstrates how airborne ultrasound generated by electric faults can be detected even when no abnormal temperatures occur, and how electric faults on high tension transmission and distribution lines can be isolated at distances of over 150'.

Predictive maintenance: who needs it?*Richard L. Harrison, Vibration analyst, Consolidated Diesel Company, Whitakers, North Carolina*

Predictive maintenance combines vibration analysis, oil sample analysis, and IR thermography in order to warn of impending failure, so that a proactive approach can be used. This paper zeros in on the significance of IR thermography in the PdM program with some dramatic case studies.

NEW - Prediction of crack propagation in concrete elements, covered by advanced composite materials, using infrared thermography*Rita Hu, University of Glamorgan, UK*

How IR thermography may be used to predict crack propagation in reinforced concrete structures is explained in this paper, which also explores some of the potential benefits of this promising ap-

proach to early prediction of beam failure.

Use of infrared thermography as a standard in the quality assurance and quality control of masonry construction*Matthew J. Innocenzi & J. Eric Peterson, Whitlock Dalrymple Poston & Assoc., Inc., Manassas, Virginia*

Architectural experts demonstrate how infrared thermography can be used in detecting the flaws which may occur in reinforced masonry wall construction, and review the advantages of using infrared thermography as part of a standard inspection or quality assurance program.

Finding termites with thermal imaging*Ken James, Director, Termicam, Australia.*

The problem of building termite damage is increasing due to the banning of many environmentally unsafe chemicals. This paper demonstrates how IR thermal imaging offers an environmentally friendly way of detecting termites and helping to safeguard buildings.

NEW - Building thermography in Finland*Timo Kauppinen, VTT Bldg. and Transport, Oulu, Finland*

The number of thermal imagers in active use in Finland is one of the highest in Europe. A world-renowned Finnish thermographer provides an update on evolving Finnish standards for IR thermographic building inspections, including some excellent comparative case histories.

Thermographic surveys involving rubber based cap-sheet membranes.*Kathryn M. Barker Knettel, American Infrared Testing & Consulting, St. Petersburg, Florida*

An expert thermographer specializing in roofs and structures, reviews IR case studies of roof systems using rubber membrane cap-sheets and various insulation materials. Problems encountered in establishing scanning techniques and interpreting results are highlighted.

Using FEA-based heat transfer analysis to extend the scope of IR*Jack M. Kleinfeld, P.E., Kleinfeld Technical Services, Inc., The Bronx, New York*

This paper introduces Finite Element Analysis (FEA). Examples will be presented that demonstrate how IR and FEA can be combined to improve the use of IR and to make the thermographer more useful, more efficient, and more effective.

(Continued on page 5)

INFRAMATION 2002 ABSTRACT SUMMARIES

(Continued from page 4)

NEW - Applying IR Thermography to ensure passenger comfort in automotive design

Maurice Lee, Thermographic Consultant, Leicester-shire, UK and Herb Kaplan, Honeyhill Technical Company, Norwalk, CT

Case histories are reviewed in this paper, which describes the application of an infrared imaging radiometer to thermal design verification of three challenging aspects of passenger comfort in a contemporary motor vehicle: windshield design, airflow patterns and airflow measurements.

NEW - Important measurements that support IR surveys in substations

Ken Leonard, Carolina Power & Light and Robert Madding, ITC, FLIR, Boston

Load (current), wind speed and connection resistance are very important values that strongly affect the apparent severity of a problem discovered during an IR scan. This paper tells you how to make these measurements safely using inexpensive instrumentation that is currently available.

NEW - How to guarantee your failure as an infrared thermographer

Ronald Lucier, ITC, FLIR Boston

IR thermographers can fall into two categories—heroes or goats. This paper highlights ten common activities that, if not properly addressed, can lead a thermographer down the path to failure. By recognizing and avoiding these pitfalls the path to success will be much clearer.

Oil circuit breaker (OCB) thermography

Robert Madding, ITC, FLIR Boston, David Ayers, TXU and Jon Giesecke, EPRI Solutions

This paper presents some OCB thermography data and examines problem severity using the watt loss calculation software developed by Dr. Madding and presented at InfraMation 2001. Post mortem photos of an OCB's internals also lend strong validation to the calculation and the calculation software.

The role of building sciences in predictive maintenance programs

Phillip C. McMullan, TSI Thermo-Scan Inspections, Carmel, Illinois

As building sciences have matured and infrared cameras have improved, the use of nondestructive infrared imaging to examine the building envelope for potential mold causing water leaks provides the opportunity to expand the role of predictive maintenance in facilities. This paper will detail the procedures of non-destructive evaluation on a variety of buildings and report the findings of

these inspections.

Thermography for computer room inspections

Curt A. Nessel, 3M Company, St. Paul, Minnesota

The application of infrared thermography to the predictive maintenance inspection of computer room equipment is reviewed. Several cost avoidance case histories are presented where the early detection of loose and defective connectors averted emergency shutdowns.

NEW - What's your IQ (Insulation Quality)?

Dan Ninedorf, Specialized Camera Sales & Service, LLC

This paper reviews the multidisciplinary approach to non-contact insulation quality determination using the combination of IR thermography, ultrasound and corona imaging cameras. Several case histories are presented.

Solution-oriented asset reliability for thermographers

Terrance O'Hanlon, publisher Rellabilityweb.com, Fort Myers, Florida

This paper outlines a human approach to Action-Oriented Solutions for a maintenance operation. Each method is defined, explained and illustrated. By the end of this presentation, we will have exposed participants to a huge selection of strategies.

Using infrared thermography on offshore platform equipment

Albert Amedee Ohliger, Chevron-Texaco Inc. Bellaire, Texas

A pilot IR survey was done to define how IR could be used on the unique equipment installation of offshore platforms. This paper reports on the survey, on the prediction of a high payback to performing surveys of offshore platforms and on some unique opportunities for the thermographer.

The highs and lows of current-available and temperature relationships

Nina Olinger, General Motors, Oklahoma City Plant, Oklahoma

The quality of parts produced for automobile manufacturing can be optimized by using infrared cameras. Examples will be shown where levels of available automation are matched with solutions. In each example the cost savings justifying the approach will be discussed.

Infrared inspections of electric substations: the importance of developing a plan

James Dan Roark, Knoxville Utilities Board, Knoxville, Tennessee

As you enter an electric substation, it becomes evident that an IR inspection plan has to be developed—a defined

plan is absolutely necessary to assure no equipment is overlooked. This paper reviews KUB's plan and offers some general guidelines for developing a customized plan.

Holistic predictive engineering

Angus Robertson, Capital PdM, Essex, UK

A modern "holistic" approach to predictive engineering is introduced, combining thermal imaging, vibration analysis, power monitoring, oil analysis, acoustic analysis, BMS dilapidation reports and energy audits. Several examples are cited.

Infrared inspection viewing ports

Martin Robinson, Capital PdM, Essex, UK

This paper explains the benefits and limitations of infrared transmitting viewing ports in inspecting areas otherwise inaccessible to IR instruments. Topics included in the discussions are window materials, safety code restrictions, viewing angle limitations and transmission losses.

Thermal characterization of substation class metal-oxide varistor (MOV) surge arresters.

David Rueger, EPRI Solutions, Lenox, Massachusetts

An overview of the thermal characteristics of station class (MOV) surge arresters is presented in this paper. Indirect thermal measurements of external arrester surfaces are compared to power dissipation levels determined by traditional voltage and leakage current measurements.

Nondestructive testing of building envelope systems using infrared thermography

John Snell, Snell Infrared, Montpelier, Vermont

The numerous applications for infrared thermography currently being used to inspect building envelopes are reviewed. These include conduction and air leakage, moisture intrusion and the degradation of roofs and facades. Examples are given for each application and the basic conditions required discussed.

Infrared applications everywhere!

Greg Stockton, Stockton Infrared Services

Infrared thermographers see the world as a big radiator, with eyes nobody else has. Getting paid to walk around and look at things with an IR camera is a dream come true. To the interested, inquisitive, infrared thermographer, applications seem endless. This paper focuses on myriad great applications for this dynamic technology.

(Continued on page 6)

ABSTRACTS (CONTD.)

(Continued from page 5)

Five uncommon component anomalies

Richard Strmiska, Sumter Electric Cooperative, Inc, Sumterville, Florida.

IR surveys offer the option of a scheduled maintenance repair time instead of sudden failure. This paper reports on five examples in which the exact cause of thermal variants were diagnosed by Sumter Electric and corrected, thus avoiding costly outages resulting from equipment failure.

NEW - Infrared diagnostics of substation line fuse problems

Jeff Sullivan, Mississippi Power Company, Hattiesburg, MS

This paper reviews Mississippi Power's predictive maintenance program, specifically regarding the IR scanning of substation line fuses. It explains various typical findings related to line fuses and explains the diagnostics of the problems found during infrared scanning.

Troubleshooting paper machine problems through thermal imaging

Robin Thon, Albany International Corp., Cornell, Wisconsin and Ron Lucier, ITC, FLIR Boston

Four case studies are cited, where problems are diagnosed through thermography, These include flawed coater marks, plugged or worn nozzles, moisture profile non-uniformity and vacuum system pulsation, representing but a few of the opportunities to troubleshoot the paper process.

The application of thermography for the on-line quality inspection of materials and processes

Michael L. Watkins, Exponent Scientific, Chester, VA

This paper reviews a real-world example to illustrate the successful development of a thermal nondestructive evaluation (TNDE) protocol to detect and quantify a unique material flaw. TNDE was used to investigate the quality of an alloy material during the manufacturing process.

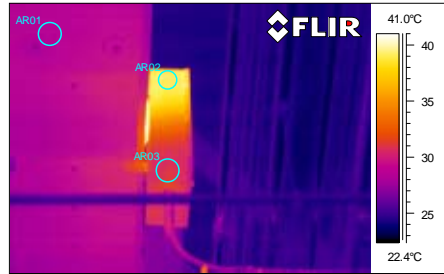
Lessons learned: using low cost, uncooled infrared cameras for the rapid liquid level assessment of chemical UXO and storage vessels

Kevin L. Young, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho

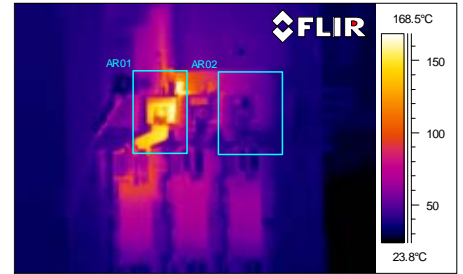
This paper describes the lessons learned, problems encountered and success rates associated with using low-cost infrared cameras to look for liquid levels within one-ton shipping containers and individual chemical munitions. ♦

PDM PROGRAM RESULTS (CONTD.)

Buss Plug B- Paint



Delta "T" on outside of box of 8°C from top to bottom.



Delta "T" on inside of box of 97°C between phase "A" and "C".

(Continued from page 1)

already completed their Level I certification with ITC, and had previously established routes to perform buss inspections, they were able to respond to this request immediately.

As a result, the PDM Team identified another buss plug in Paint as well as one in the Assembly department that were close to the same condition as the plug that had caught fire.

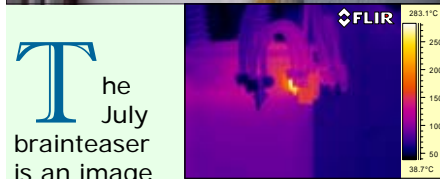
In fact, the buss plug in assembly was deteriorated so badly that if the disconnect switch had been thrown to shut off the power, it would have appeared to be off, but in actuality the knife switches were welded together (*which explained why the Delta "T" was not as high as the other anomaly*) and the

power would have still been on. This posed not only a fire hazard, but a potentially hazardous safety condition for any plant maintenance personnel who had to work on this equipment. See the thermograms below.

Bottomline Plant & Program Benefits

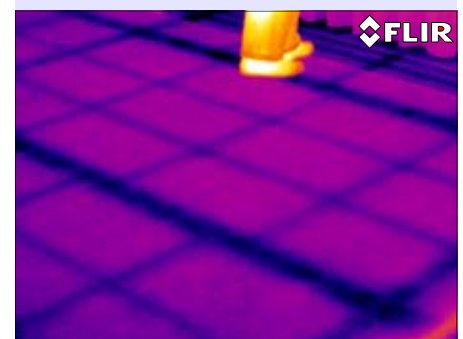
The cost avoidance realized from these two finds, was in the neighborhood of ~\$300,000.00, but more importantly, it provided the PDM Team with an excellent opportunity to highlight the benefits of Predictive Maintenance. Unfortunately, unless publicized, the value-added activities of the PDM Team often go unnoticed, in comparison to normal maintenance fire fighting activity during equipment breakdowns. ♦

LAST MONTH'S BRAINTEASER



The July brainteaser is an image of a can type transformer with a bad secondary bushing connection, (probably the internal connection from the image). Congratulations to Michael Gregg from ComEd in Oakbrook Terrace, IL for his correct assessment. ♦

BRAINTEASER OF THE MONTH



Here is this month's brainteaser. First reader to email me with the correct explanation wins \$20 in Infrabucks. Please put "Brainteaser" as the subject of the message. ♦



Mailto: Gary.Orlove@infraredtraining.com



Infrared Thermography

Boston

Training Courses

"Delivering world-class training and knowledge about thermography"

Level I Certification Course

This 4 ½ day Level I course is geared to the new IR camera user and focuses on its use for a variety of applications.

Attendees completing course requirements and a field assignment will receive a Level I Thermography Certification.

Course Highlights

Introduction to thermal imaging and measurement systems for predictive maintenance applications. No experience in thermography is necessary!

Collect quality data, accurate temperature readings, and account for measurement effects such as distance and emissivity using IR cameras.

Interpret thermograms and make informed decisions using heat transfer concepts to analyze images, and see the latest in report generation and database software.

Avoid costly mistakes - distinguish between hot spots and reflections, direct vs. indirect readings and qualitative vs. quantitative thermography.

Learn in the world's only dedicated hands on thermography training laboratories - more than 16 workstations with electrical, piping, bearings, motors, buss duct, valves, PCBs, and more!

Learn and practice report generation using IR software at our 22 station computer laboratory.



ThermaCAM Reporter and Database Software Training

This one day course is designed to provide students with the skills necessary to utilize the ThermaCAM Reporter software, in conjunction with the Database software, to produce infrared reports. Upon successful completion of this course, students will:

Understand the process of transferring infrared images from the PCMCIA card to the computer.



Have the ability to design and customize a template to meet the students' specific needs.

Have the skills necessary to efficiently generate high-quality reports.

Understand how to archive data and query on specific report parameters using the Database software.

Understand how to automate the report generation process using the Quick template and text comments.

Our state of the art computer lab provides students with hands-on experience at their own workstation. Each student will have the opportunity to use the software and create a template using the concepts discussed in class.



Registration Information

Level I Certification	
Dates:	09/9-13/2002
Time:	08:00
Location:	16 Esquire Rd N. Billerica, MA 01862
Travel Recommendation:	Fly in to Boston, MA or Manchester, NH airports
Lodging Recommendation:	Wyndham Billerica 270 Concord Rd. Billerica, MA 01821 (978) 670-7500

Software Training	
Dates:	09/18/2002
Time:	08:00
Location:	16 Esquire Rd N. Billerica, MA 01862
Travel Recommendation:	Fly in to Boston, MA or Manchester, NH airports
Lodging Recommendation:	Wyndham Billerica 270 Concord Rd. Billerica, MA 01821 (978) 670-7500

LEVEL I TUITION

A registration fee of \$1550 includes 4 ½ day seminar cost, breakfast/lunch, one course dinner, and all course materials.

SOFTWARE TUITION

A registration fee of \$695 includes 1 day seminar cost, breakfast/lunch, and all course materials.

REGISTRATION

If you have any questions or to register, please contact Laurie Kelley:

(978) 901-8291 or toll free at 1-866 TrainIR (872-4647)

<http://www.infraredtraining.com/>



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Fax: +46 (0) 8 753 26 01

E-mail: <mailto:itc@flir.se>

About the Infrared Training Center

The Infrared Training Center offers training and certification in all aspects of infrared thermography use. Our world-class training facilities are located near Boston, Massachusetts, USA and Stockholm, Sweden and have the world's most extensive hands on laboratories for infrared applications. Please join us in exploring the fascinating world of infrared!

Your comments and suggestions about this newsletter are welcomed and encouraged. If you have an interesting application or case study to share, we encourage you to submit it for publication.

Please e-mail

mailto:Gary.Orlove@infraredtraining.com or regular mail to the USA office

"Delivering world-class training and knowledge about thermography"



itc **INFRAMATION** - Editor / Publisher: Gary Orlove

Upcoming Classes - Americas

Remember we also teach customer site training courses at your convenience. Please contact us for more information.

August 2002

- 5-9 – Level I – Boston, MA
- 6-9 – Level I – Chicago, IL
- 6-9 – Level I – Denver, CO
- 12-15 – Level II – Chicago, IL
- 13-16 – Level I – San Francisco, CA
- 26-29 - Level I - Honolulu, HI

September 2002

- 9-13 – Level I – Boston, MA
- 9-13 – Level I – Argentina
- 10-13 - Level I - Edmonton, Canada
- 16-19 – Level II – Edmonton, Canada
- 16-19 - Level II - Prince George, BC
- 17-19 – R&D – Santa Clara, CA
- 17-20 – Level I – Raleigh, NC
- 18 – ThermaCAM Reporter Software- Boston, MA
- 23-26 – Level I – Toronto, Canada
- 23-27 – Level II – Boston, MA
- **29-Oct 2 - InfrAMation Conference - Orlando**

October 2002

- 7-11 – Level I – Chile
- 14-18 – Level I – Boston, MA
- 14-17 – Level II – San Diego, CA
- 14-18 – Level I – Mexico
- 21-24 - Level I - Vancouver, BC
- 22-24 – R&D – Boston, MA
- 22-25 - Level I - Anchorage, AK
- 28-11/1 – Level I – Venezuela

November 2002

- 4-8 – Level I – Boston, MA
- 5-8 – Level I – Seattle, WA
- 4-8 – Level I – Brazil
- 18-22 – Level II – Boston, MA
- 19-22 – Level I – Atlanta, GA

Upcoming Classes - International

August 2002

- No Courses

September 2002

- 2-6 - Level I - Singapore
- 9-13 - Level II
- 9-13 - Level I - Malaysia
- 16-20 - Level I - UK

October 2002

- 7-11 - Level I - Asia
- 14-18 - Level I - Asia
- 28-Nov 1 - Level I - South Africa

November 2002

- 11-15 - Level I (Swedish)

Upcoming Classes - Germany

August 2002

- No Courses

September 2002

- 16-18 - Operator CM
- 16-21 - Level I EN 473

October 2002

- 8-10 - R&D
- 21-23 - Operator CM
- 21-26 - Level I EN 473

November 2002

- 18-20 - Operator CM
- 18-23 - Level I EN 473

Infrared Camera Rentals

Rent an infrared camera from FLIR Systems to locate electrical and mechanical problems, schedule repairs, and avoid costly plant shutdowns. Whether you have a temporary testing/inspection requirement or need to evaluate an IR camera before purchasing, renting from FLIR can help you solve problems.

- Rent direct from the world leading IR camera manufacturer
- Low rates and quick delivery
- Build credit toward purchase
- Wide selection of camera technologies and accessories

For more information call us toll free at **1 (866) IR RENTS**
1 (866) 477 3687
<http://www.infraredcamerarentals.flir.com>

Upcoming Classes - France

August 2002

- No courses

September 2002

- 30-October 2

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