## How-To Courses Wednesday March 15, 2017

If you've ever wanted some practical guidelines on how-to 'Choose Between Heat Pipes & Vapor Chambers', for instance, or 'Select the Best Air Mover', you won't want to miss these 50 minute presentations. Join our thermal industry veterans as they offer concise insight into their field of specialty, while leaving 10 minutes for some Q&A. Attendees can choose from four presentations on Wednesday, the third evening of the symposium.

*How-To Presentations open to all symposium attendees*

**Thermocouple Theory and Practice** **Presenter: Bob Moffatt**

Conceptually, thermocouples are very simple: two wires joined together at one end and connected to an instrument at the other. Put the junction on a device, read the signal and and learn ---- the temperature of the thermocouple! The problem is that you generally don't care what the thermocouple temperature is, you want to know the temperature of the device to which it is attached. To get the job done, you need to know about thermocouple theory, but also about radiation error and conduction error and, in some cases, velocity error. In this hour, we will cover the physics of TC's, apply that theory to circuits with connectors, and introduce you to the environmental errors you will face.

**Dr. Robert J. Moffatt** has ten years of experience with the General Motors Research Labs and thirty-one years at Stanford University working on heat transfer and experimental methods. He pioneered the use of uncertainty analysis in experimental planning. Dr. Moffat worked with Dr. Alvin Hackel, a pediatric anesthesiologist, to develop the Stanford Transport Incubator for inter-hospital transport of critically ill premature infants for which he was rewarded the ASME Melville Medal. He has more than 240 publications.

**Design of Liquid Cooled Systems** **Presenter: Pablo Hidalgo, Thermacore, Inc.**

The increase in computing capabilities and larger heat dissipations is approaching its limits of air cooled systems in certain applications. Technology is advancing towards an increasing number of liquid cooled systems due to its cost-effective performance for high-power, high-heat flux electronics such as microprocessors, IGBTs or power modules. Since liquid forced convection has at least an order of magnitude higher heat transfer coefficients than forced air convection, at the expense of higher overall pressure drop, the heat transfer mechanism is significantly more effective. In this presentation, comprehensive design steps and guidelines for designing any kind of liquid cooled system will be addressed.

**Pablo Hidalgo** is a senior thermal engineer in the R&D group at Thermacore working on the development of new products for military, aerospace, data centers and medical applications. Previously he has spent eight years in the department of mechanical engineer at the Georgia Institute of Technology working as a research engineer. During his tenure at Georgia Tech, he worked in thermal management of high power electronics using diverse flow control techniques and aerodynamics.

# SEMI-THERM 33

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**Design Consideration for Heat Sink Mounting Solution** **Presenters: Dr. Milena Vujosevic, Intel**
**Juan L. Cruz, Light**

As systems are becoming more densely packed with more components added on the board and/or with board becoming smaller, the heat sink attachment designs need to become more innovative. This requires engineer to become more aware of the impact that heat sink mount design choice can have on the performance and reliability of electronic components. In this course we will discuss the multitude of challenges that need to be taken into the account when designing heatsink mounting solutions. Special focus will be on explaining why successful heat sink mounting solutions need to account for both heat transfer and mechanical considerations.

**Dr. Milena Vujosevic** is a Principal Engineer and Senior Manager in Intel's Quality and Reliability Organization. She leads strategic developments in package certification, Multiphysics predictive modeling methodologies and co-optimization of customers' board assembly solutions. She has more than 20 years of experience in engineering and management of multidisciplinary teams includingincluding: technology development, product design, quality and reliability, research and teaching. Prior to joining Intel in 2005, she worked for Motorola in the area of MEMS. Milena has a PhD in Mechanical Engineering. She has more than 60 technical publications.

**Juan L Cruz** is Thermal Mechanical Engineer at Light. Juan has worked in the thermal management field for over 15 years solving a multitude of thermal challenges. He was the lead Thermal Architect at Ericsson where he developed innovative thermal solutions for high end router that used up to 80KW per rack.

**Practical Guidelines for Using Heat Pipes and Vapor Chambers in Heat Sinks**

**Presenter: George Meyer**

Heat pipes, and increasingly vapor chambers, are common devices used to improve heat sink thermal performance by over 30% when compared to solid metal alternatives. This course will cover two-phase device similarities, differences, misconceptions, best uses, sizing and performance modeling through the presentation of numerous examples.

**Who Should Attend:** Engineers interested in learning about how to best incorporate heat pipes and/or vapor chambers into their next heat sink design.

**George Meyer** is a thermal industry veteran with over three decades of experience in electronics thermal management. He currently serves as the CEO of Celsia Inc., a design and manufacturing company specializing in custom heat sink assemblies using heat pipes and vapor chambers. Previously, Mr. Meyer spent twenty-eight years with Thermacore in various executive roles including Chairman of the company's Taiwan operations. He holds over 70 patents in heat sink and heat pipe technologies and serves as a chairperson for both Semi-Therm and IMAPS thermal conferences in the San Francisco area.

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