Join us for our next webinar! Cooling Techniques for Electronic Equipment by Steve Carlson

April 17-18, 2018 8:30 am – 12:30 pm Pacific time (California)
Cost $800 per person, group discounts available if you have five or more from same company.

Register here!

This is a two day extensive webinar presented, 4 hours each day. Attendees must participate in both days. Don't wait until your electronic equipment over-heats or fails because of poor cooling. Find out if your present systems are adequately cooled, how to avoid many common cooling problems and how to design efficient, reliable cooling systems for many different types of electronic cabinets. The purpose of this webinar is to show designers and engineers an overview of the quick methods for designing electronic equipment to withstand severe thermal environments without failing. Techniques are presented which will permit the evaluation and design of cost effective, compact cooling systems, without the aid of a large digital computer.

Learn simple design rules, and guidelines, which can improve the effective cooling of your sophisticated electronic components used in today's military, industrial and commercial electronic systems. Learn methods for determining thermal stresses in lead wires and solder joints due to a mismatch in thermal expansions.

This course is based upon the popular book Cooling Techniques for Electronic Equipment by Mr. Dave Steinberg. Questions are encouraged during the webinar, to make sure each participant understands the design techniques and application presented.

Electronics Cooling Background
Heat Transfer within Electronic Systems
Conduction
Natural and Forced Convection
Radiation
Types of Thermal Analyses
Steady-State and Transient
Common Electrical Components and their Construction
Types of Electronic Enclosures
Material Properties and Unit Conversions

Practical Conduction Cooling Design Guidelines
Calculate Temperature Rise
Concentrated Heat Loading
Uniform Heat Loading
Determine Heat Flow
Tracing a Heat Conduction Path from Heat Source To Sink
One and Two Dimensional Resistor Networks
Parallel and Series Heat Flow
Printed Circuit Boards (PCB)
Determine Component Junction Temperature: θcb & θjc
Using Internal Ground and Voltage Planes to Spread Heat
Calculate Effective PCB Thermal Conductivity
Mounting High Power Components on Circuit Boards
Calculate Thermal Interface Impedance
Bolted Contact Resistance
Effects of Surface Finish, Hardness and Pressure on Interface Resistance
Thermal Resistance Across Different Board Edge Guides
Sample Problems to Promote Better Understanding

**Mounting Various Types of Components on Circuit Boards**
Problems with Surface Mounting Components
Leadless Chip Carriers, Transformers, Ball Grid Arrays, Large Multi-Chip Modules, and Large Fine Pitch Leaded Components
Problems with Through Hole Mounting Components
Pin Grid Arrays
Small Axial Leaded Resistors
Lead Wire Strain Relief
Various Types Of Lead Wire Strain Relief To Prevent Solder Failures
Avoiding Cracking of Chip Resistors and Capacitors
Case Histories on Successes and Failures

**Effective Natural Convection and Radiation Cooling**
Free Convection
Required Spacing Between Circuit Boards for Good Cooling
How Altitude Effects Natural Convection Cooling
Finned Heat Transfer Surfaces
Adding External Fins on a Box To Improve Cooling
Making Effective Use Of Extruded Fin Heat Sinks
Methods For Increasing Convection And Radiation Coefficients
Combining Convection And Radiation Cooling
Radiation Heat Transfer
Sample Problems To Demonstrate Practical Applications

**Methods for Improving Forced Convection Cooling**
Cooling Fans
Air Flow Properties of Fans and Blowers (Fan Curve)
Working with Sigma Delta Pressure Drop
Fan Location
Typical Problems with Improper Fan Installation
How To Determine and Cure Short Circuit Cooling Air Flow Path
Flow Losses
Understanding Static, Velocity and Total Pressure
Flow Losses Due to Entrance, Exit, Expansion and Turns
Fan Selection
Matching the Impedance Curves for Chassis and Fan
Sample Problems to Illustrate Cost Effective Applications

**Practical Design and Analysis Guidelines**
Hand-calculations confirm Finite Element Analysis results
Coefficient of Thermal Expansion
Thermal Expansion Equilibrium Equations, Lead Wires, Solder
Slow Thermal Cycling Solder Creep Forces, Stresses, Fatigue Life
Case Histories to Promote Improved Electronic Design

**WHO SHOULD ATTEND?**
R&D Electronic Engineers and Managers
Packaging Engineers
Quality & Reliability Engineers
Test Engineers
Manufacturing Engineers
Mechanical Engineers
Application and Sale Engineers

**INSTRUCTOR: Steven Carlson** has over 19 years of extensive experience in defense/aerospace industry dealing with design and analysis of electronic hardware with a strong understanding of thermal and structural analysis. He is the principal engineer at Carlson Mechanical Engineering and has provided mechanical analysis services to Northrop
Grumman, Physical Optics Corporation, and multiple other electronic manufacturers for military and commercial applications. Steve holds a Masters in Mechanical Engineering and currently works at Jet Propulsion Laboratory (JPL) performing thermal and structural analyses on space based electronic hardware. Steve learned the classical techniques for analyzing electronic hardware from Joel Sloan (author Design and Packaging of Electronic Equipment) who was a colleague of Dave Steinberg (author of multiple thermal and vibration analysis books) at Litton Guidance and Control Systems. Steve has expanded the classical techniques to include modern solid modeling and Finite Element Analysis to reduce analysis time, improve accuracy, and decrease product development time. He worked under the mentorship of Joel Sloan at Litton Guidance and Control Systems on navigation grade systems (LN-100, LN-200, and LN25x) and development programs (Fiber Optic Gyro and Silicon Accelerometer). Steve has worked on multiple flight programs at JPL including the Mars Science Laboratory and Juno performing heat transfer and vibration analyses on electronic hardware at component and system level.

Cost: $800 per person for both days. If you have five or more from the same company the price is $720 per person.