

## Panel Discussion

Thursday March 19, 2020 2:00p.m – 4:00p.m.

### Liquid Cooling

For the last 10 years, Liquid Cooling has been a “technology that will be widely adopted in the next 2 to 3 years.” Are we actually at that place now? What are the barriers to adoption that may keep liquids out of electronics chassis for even longer? What are the “dream features” of a cooling technology that would truly remove thermal constraints in your application area (without breaking any laws of physics)? What are the applications where there is no choice but to use liquid for electronics cooling? This panel will provide a unique perspective on these and other questions, with representatives of the following end users and implementers:

- ES2 NSF Industry-University consortium
- Collins Aerospace
- Oak Ridge National Laboratory
- Service Logic
- Microsoft
- Intel

#### Panel Members:

Cathy Biber, Intel

Greg Crumpton, Service Logic Corporation

David Grant, Oak Ridge National Laboratory (ORNL)

Alfonso Ortega, Villanova University

Debabrata Pal, Collins Aerospace

Brandon Rubenstein, Microsoft

Moderator: Tim Shedd, ZutaCore

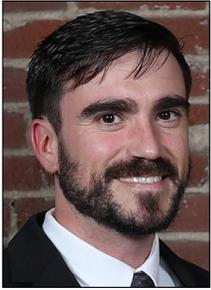


**Cathy Biber** is a thermal engineer currently architecting systems in Intel’s Data Platforms Group, working primarily on server products. She has experience across a wide range of electronics cooling applications.



**Greg Crumpton** was named Vice President of Critical Environments and Facilities in 2016. In his current role, Greg drives Service Logic’s vertical market penetration in the mission critical segment, and oversees EH&S across Service Logic and its operating units. Greg joined Service Logic in 2014 with the sale of AirTight Mechanical, the company he founded and has led since 1999. As founder and president, he built a remarkable company that had a proven track record and expertise in serving the mission critical market throughout the Carolinas and is a foremost expert in mission critical applications and facilities. Prior to founding AirTight, Greg worked as a Division General Manager of Project Management and in sales capacities for McKenney’s, Inc.

Greg serves on the advisory boards of Ebullient, LLC a designer and manufacturer of liquid cooling products for data center applications and Atom Power Inc. a designer and manufacturer of advanced electronic circuit breakers.



**David Grant** graduated from the University of Tennessee in 2003 with a B.S. in Mechanical Engineering. He has been at the Oak Ridge National Laboratory (ORNL) since 2009 where he has been involved with the design, construction, and operation of the mechanical systems supporting ORNL's 80,000SF+ of data centers which house Summit, the world's fastest high performance computer, among others. Current work is focused on facility upgrades to enable a future exascale system. He is currently a co-chair of the Energy Efficient HPC Working Group Infrastructure sub-team and is a corresponding member of the ASHRAE TC9.9. David is a registered Professional Engineer with the State of Tennessee and is a Certified Energy Manager (CEM - from the Association of Energy Engineers (AEE))

and a Data Center Energy Practitioner – Specialist (DCEP - from the Department of Energy (DOE)). He has 13 issued patents.



**Dr. Alfonso Ortega** is the James R. Birle Professor of Energy Technology at Villanova University. He is the Director of the Laboratory for Advanced Thermal and Fluid Systems and the Founding Director of the Villanova site of the NSF Center for Energy Smart Electronic Systems (ES2) founded in 2011. He is currently Associate Director of the NSF ES2 Center.

He received his B.S. from The University of Texas-El Paso, and his M.S. and Ph.D. from Stanford University, all in Mechanical Engineering. He was on the faculty of the Department of Aerospace and Mechanical Engineering at The University of Arizona in Tucson for 18 years. For two years, he served as the Program Director for Thermal Transport and

Thermal Processing in the Chemical and Transport Systems Division of The National Science Foundation, where he managed the NSF's primary program funding heat transfer and thermal technology research in U.S. universities.

Dr. Ortega is a teacher of thermal sciences and experimental methods. He is an internationally recognized expert in the areas of thermal management in electronic systems. He has supervised over 40 M.S. and Ph.D. candidates to degree completion, 5 postdoctoral researchers, and more than 70 undergraduate research students. He is the author of over 300 journal and symposia papers, book chapters, and monographs and is a frequent short course lecturer on thermal management and experimental measurements.

He is a Fellow of the ASME and received the 2003 SEMITHERM Thermie Award and the 2017 IThERM Achievement Award in recognition of his contributions to the field of electronics thermal measurements.



**Brandon Rubenstein** is the Director of Hardware Development Engineering for Microsoft Azure's Cloud Server Infrastructure group. His team is responsible for providing the IT and supporting infrastructure at Hyperscale on which Microsoft's cloud based platforms operate. Brandon was the director, architect and lead designer for the mechanical and thermal systems for Microsoft's current cloud server product line, which is also known within the Open Compute Project as Project Olympus and Opencloud Server. Before this, he designed the thermal solution for the first generation of Microsoft Surface tablet products. Before joining Microsoft, Brandon was the lead thermal engineer for Hewlett Packard's Enterprise Server Group, developing mechanical and thermal solutions for

four generations of Hewlett-Packard's Superdome Enterprise server products over 10 years as well as architecting the HP Apollo liquid cooled "thermal busbar" solution.

Brandon holds over 30 patents and has authored and co-authored several technical papers regarding thermal optimization through modelling. Brandon graduated from Purdue University with a BSME and the University of Wisconsin with an MSME.



**Debabrata Pal** is a Technical Fellow working at Collins Aerospace, a United Technologies Corporation company. He has B.S, M.S and Ph.D. all in mechanical engineering. He currently leads thermal design of aircraft electrical and electronic systems. Debabrata actively mentors co-op students and engineers. He prepares and teaches classes on thermal management in the Collins Aerospace Technical University. . He has published book chapters, journal papers, conference papers and various patents.



**Dr. Timothy A. Shedd** is currently Director of Product Management for ZutaCore, Inc. Most recently, he was the Director of the Graduate Program, Supervisor of Entrepreneurship Programs and an Associate Professor of Mechanical Engineering at Florida Polytechnic University. Prior, he was an Assistant, then Associate, Professor of Mechanical Engineering at the University of Wisconsin from 2001 to 2016. In 2012, while still a faculty member, Shedd founded Ebullient, Inc., to commercialize a two-phase cooling system for data centers. He holds a B.S. in Electrical Engineering from Purdue University and M.S. and Ph.D. degrees in Mechanical Engineering from the University of Illinois at Urbana-Champaign. He has received an NSF CAREER award, an ASHRAE New Investigator Award, and a number of teaching and research awards during his academic career. Most recently (2016), Dr. Shedd has been named a Fellow of ASHRAE (the American Society of Heating, Refrigeration and Air-conditioning Engineers).

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