

# IMAPS Advanced Technology Workshop on High Reliability Microelectronics for Military Applications

Holiday Inn Baltimore-BWI International Airport

*(Soon to be the Doubletree BWI)*

Linthicum Heights, Maryland - USA

May 17 - 19, 2011

## Final Program



### General Chair:

**Greg Caswell**

DfR Solutions, LLC

[gcaswell@dfrsolutions.com](mailto:gcaswell@dfrsolutions.com)

### Technical Team:

Bruce Romenesko, JHU-APL - [Bruce.Romenesko@jhuapl.edu](mailto:Bruce.Romenesko@jhuapl.edu)

Jeremy Palmer, Sandia National Laboratories - [japalme@sandia.gov](mailto:japalme@sandia.gov)

Jeff Kennedy, Celestica, Inc. - [kennedj@celestica.com](mailto:kennedj@celestica.com)

Carolynn Drudik, DMEA - [carolynn.drudik@dmea.osd.mil](mailto:carolynn.drudik@dmea.osd.mil)



Organized by: The International Microelectronics And Packaging Society **(IMAPS)**

*Bringing Together the Entire Microelectronics Supply Chain!*

## Workshop Overview

In our current global situation where the focus is on military electronics reliability and performance in hostile environments, extensive work is being done to advance the state-of-the-art in high reliability electronics packaging. The technical program will focus on the latest military electronic devices, systems, and applications, with particular emphasis on system level issues that have an impact on mission assurance as well as the connected issues at the design and applications level.

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**Tuesday, May 17<sup>th</sup>**

Registration: 7:00 am - 5:40 pm

Continental Breakfast: 7:15 am - 8:00 am

**OPENING REMARKS: 8:00 AM - 8:15 AM**

General Chair: Greg Caswell, DfR Solutions, LLC

**KEYNOTE PRESENTATION: 8:15 AM - 9:00 AM**

**Title:** Department of Homeland Security Project Shield America Export Compliance

**Speaker:** William F. Corcoran, Special Agent, Department of Homeland Security

### **SESSION 1: RELIABILITY ISSUES**

Session Chair: Jeff Kennedy, Celestica, Inc.

9:00 am - 12:00 pm

TA11 CLCC Solder Joint Life Prediction under Complex Temperature Cycling Loading

Fei Chai, Michael Osterman, Michael Pecht, University of Maryland - CALCE

TA12 Thermal Cycling Reliability of Sn96.5Ag3.0Cu0.5 Solder Assembled with ENIG and OSP Pad Finishes

Preeti Chauhan, Michael Osterman, Michael Pecht, University of Maryland

TA13 Impact of Dwell Time on Solder Joint Reliability under Four Point Bend Testing

Sandeep Menon, Michael Osterman, University of Maryland - CALCE

**Break: 10:30 am - 11:00 am**

TA14 Effectiveness of Conformal Coatings on Surface Mount Components as Tin Whisker Mitigation

Sungwon Han, Curtis Johnson, Michael Osterman, Michael Pecht, University of Maryland - CALCE

TA15 3D X-Ray CT Analysis of Solder Joints in Area Array Electronic Package Assemblies

Rajen Chanchani, Jeremy Palmer, Sandia National Laboratories

**Lunch: 12:00 pm - 1:20 pm**

**THANK YOU**

**A SPECIAL *THANK YOU***

TO ALL OF THE MEMBERS OF THE TECHNICAL TEAM, THE CHAIRS AND SPEAKERS.

**YOUR PARTICIPATION IS GREATLY APPRECIATED!**

## KEYNOTE SPEAKER: 1:25 PM - 2:10 PM

**Title:** The Revolution in Military Affairs: IT and CYBER

**Speaker:** Mark B. Pizzo, Colonel, USMC (Ret.); Chief of Staff / Dean of Students  
National War College



**Colonel Mark B. Pizzo** enlisted in March 1971, and was commissioned a second lieutenant in October, 1971. He reported to 3<sup>rd</sup> Marine Division, Okinawa, Japan, and was assigned to the 9<sup>th</sup> Marines where he completed duties in Vietnam and Southeast Asia. In 1974, he completed naval aerial observer training and then Amphibious Warfare School.

As a Major, from 1982 to 1984, he was assigned duties as the Commanding Officer, Marine Barracks, Sigonella, Sicily, and CO, 14<sup>th</sup> Interrogator Translator Team, Beirut, Lebanon. Following these tours, he attended the Marine Corps Command and Staff College where he was a distinguished graduate.

Upon promotion to Lieutenant Colonel, he was ordered to Washington D.C., where he served at Headquarters Marine Corps, attended the National War College, and served in the Office of the Secretary of Defense for Drug Enforcement Policy and Strategy.

Promoted to the rank of Colonel in 1993, he was ordered to Okinawa, Japan where he served as the 3<sup>rd</sup> Marine Division G3 (Operations), and as Commanding Officer, 31<sup>st</sup> Marine Expeditionary Unit (Special Operations Capable). In 1998, he was ordered to duties as the Senior Marine Fellow,

National War College, where he completes a career of over 31 years of honorable service to the nation.

In 2002, he worked as a consultant for ANSER Homeland Security and The Department of Agriculture regarding Bio-terrorism. From 2002-2004 he conducted seminars and lectures about National Security Strategy, Military Operations, and Terrorism for community outreach programs.

In 2004 he assumed the civilian position (SES equivalent) as Chief of Staff and Dean of Students of the National War College, where he continues to work and teach today.

## SESSION 2: SYSTEM LEVEL ISSUES

**Session Chair:**Carolynn Drudik, DMEA

**2:10 pm - 5:40 pm**

TP11 Conversion of a High Reliability Exempt Product to Lead-Free: Lessons Learned - 4 Years Into RoHS

Paul Bodmer, Robert Farrell, Benchmark Electronics Inc.; Jim Angell, Tony Cosentino, David Sparrow, Robert Gardiner, Tekelec, Inc.; Gregory Morose, University of Massachusetts

TP12 Structural Electronics: A New 3D Additive Manufacturing Paradigm

Ken Church, Mike Newton, Eric MacDonald, Ryan Wicker, nScript, Inc.

TP13 Microelectronics Packaging of a Micro Gas Analyzer

Jay Johnson, Dahwey Chu, Matt Moorman, R. J. Simonson, Greg Bogart, Sandia National Laboratories

**Break: 3:40 pm - 4:10 pm**

TP14 Canary - Ion Spectroscopy for Ionospheric Sensing

H. S. Feldmesser, M. A. G. Darrin, R. Osiander, L. J. Paxton, A. Q. Rogers, J. A. Marks, A. S. Francomacaro, S. J. Lehtonen, The Johns Hopkins University Applied Physics Laboratory; M. G. McHarg, R. L. Balthazor, L. H. Krause, J. G. FitzGerald, United States Air Force Academy

TP15 DNA to Safeguard Electrical Components & Protect Against Counterfeiting & Diversion

Janice Meraglia, Applied DNA Sciences

TP16 Consideration for System Level Integration of High-Reliability Microelectronics

Maxine Pennington, Honeywell Federal Manufacturing and Technology

**Wednesday, May 18<sup>th</sup>**

Registration: 7:00 am - 3:30 pm

Continental Breakfast: 7:15 am - 8:00 am

**SESSION 3: APPLICATION ISSUES**

Session Chair: Jeremy Palmer, Sandia National Laboratories

8:00 am - 11:30 am

WA11 Using Manifold Microchannel Coolers to Reduce the Power Electronics Thermal Stack

Lauren Boteler, Nicholas Jankowski, Brian Morgan, Army Research Laboratory;  
Patrick McCluskey, University of Maryland - CALCE

WA12 Prognostics of Lithium-ion Batteries using Extended Kalman Filtering

Wei He, Nick Williard, Michael Osterman, Michael Pecht, University of Maryland - CALCE

WA13 Quantitatively Predicting the Reliability of Complex Integrated Circuits

Ed Wyrwas, DfR Solutions, LLC

**Break: 9:30 am - 10:00 am**

WA14 Superhydrophobic Coatings on Electronic Components

Vinod Sikka, Andrew Jones, Ross Nanotechnologies, LLC

WA15 Why Wedge Bond?

Lee Levine, Process Solutions Consulting, Inc.; Joe Bubel, Hesse & Knipps Inc.

WA16 Predicting Remaining Capacity of Batteries for UAVs and Electric Vehicle Applications

Nick Williard, Wei He, Michael Osterman, Michael Pecht, University of Maryland - CALCE

**Lunch: 11:30 am - 12:30 pm**

**SESSION 4: PACKAGE RELATED RELIABILITY ISSUES**

Session Chairs: Greg Caswell, DfR Solutions, LLC; Pamela Ball, DoD

12:30 pm - 3:30 pm

WP11 Evaluation of Process Indicators in High-Reliability Microelectronic Package Failure Analysis

Jeremy A. Palmer, Michael K. Neilsen, Paul T. Vianco, Sandia National Laboratories

WP12 Identification of Cracked MLCCs on Printed Circuit Board Assemblies using Time Domain Reflectometry

Thomas Fritzler, Michael H. Azarian, Michael Pecht, University of Maryland

WP13 High Performance and Reliability Microelectronics Packaging

Kevin G. Ewsuk, Lu Fang, Dahwey Chu, Nathan Young, Sandia National Laboratories

**Break: 2:00 pm - 2:30 pm**

WP14 Likelihood of Metal Vapor Arc by Tin Whiskers

Sungwon Han, Michael Osterman, Michael Pecht, University of Maryland - CALCE

WP15 This Is Not a Test

Walt Tomczykowski, Cheryl Tulkoff, DfR Solutions, LLC

**Thursday, May 19<sup>th</sup>**

**Registration: 7:30 am - 11:00 am**

**Continental Breakfast: 7:30 am - 8:00 am**

## **SESSION 5: SHORT COURSE - AN EXPERT RELIABILITY ANALYSIS TOOL**

**Instructor: Dr. Nathan Blattau, Chief Technologist, DfR Solutions, LLC**

**8:00 am - 11:00 am**

This course will introduce a first-of-its-kind Electronics Design Reliability (EDR) solution that will transform the process of analyzing, grading, and certifying the expected reliability of electronics products at the circuit board level. Three outputs that become critical to the design process will be presented:

- **A reliability score** – which calculates the likelihood that a product will perform reliably in the marketplace. The higher the score, the better the reliability.
- **Predicted performance over time** – which product teams can use to help to project the profitability of a product over its lifecycle.
- **A physical map of reliability issues** – which identifies to the user the likely points of failure (red flags) for rapid comprehension.

For the first time the principles of Physics-of-failure (PoF)-based analysis - a new, more accurate method for predicting product reliability - including the following will be demonstrated, addressing:

- Thermal measurement
- PTH fatigue
- Solder fatigue
- CAF Analysis
- Mechanical response to vibration, shock, and bending
- IC Wearout
- Electrolytic Capacitor Wearout
- Component stress analysis

**Dr. Nathan Blattau**, Vice President of DfR Solutions, LLC has been involved in the packaging and reliability of electronic equipment for over eight years. Dr. Blattau is also experienced in failure analysis and accelerated testing methods. His primary research interests are in the areas of development of Physics of Failure models and algorithms, design-for-reliability in electronic packaging, nonlinear finite element analysis, solder joint reliability, fracture, and fatigue mechanics of materials. Through extensive testing, analysis, and simulation, Dr. Blattau has developed a thorough understanding of the defects and degradation mechanisms that can induce failure in Pb-free product. Due to his efforts, Dr. Blattau was recently selected to lead a comprehensive reliability study on SN100C, a Pb-free alternative that is being considered as a replacement for SAC due to superior manufacturability. Dr. Blattau has written numerous articles and holds two patents pending in software-based simulation and accelerated life testing. He holds a B.S. in Civil Engineering, M.S. in Mechanical Engineering, and Ph.D. in Mechanical Engineering, all from the University of Maryland.

**Closing Remarks: 11:00 am**

### **MET Laboratories Tour (Free to all Workshop Attendees)**

**Pre-Registration Required - See Registration Page.**

**Attendees have a special opportunity to extend their workshop with a free tour of a local testing laboratory.**

[MET Laboratories](#) does extensive MIL-STD testing, including Environmental Simulation (810, 202, 167 & RTCA/DO-160) and EMC Testing (461 & 462).

MET also does extensive testing and certification for Product Safety, Energy Star, Wireless, and Telecom/NEBS. In addition to its Baltimore lab, MET also has labs and operations in California, Texas, North Carolina, China, Korea, and Taiwan.

MET is just 7 miles away, and has offered to provide a free lunch and complimentary transportation to and from the hotel. MET will be showing off a new EMC chamber that was just built in March 2011.

#### **Here is the agenda:**

- 11:45 Leave for MET
- 12:00 Lunch at MET
- 1:00 Introduction to MET & Lab Tour
- 2:30 Leave for hotel
- 2:45 Arrive at hotel