

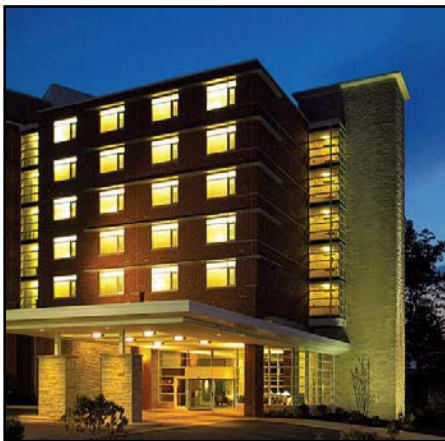


# Center of Excellence in Structural Health Monitoring

Spring Meeting  
11-12 June 2009



The Penn Stater Conference Center Hotel  
*State College, Pennsylvania*



The **purpose of the meeting** is to:

1. bring designers and owners of platforms that benefit from SHM technology together with researchers and developers of SHM systems and
2. grow the Center by building relationships that lead to fruitful multidisciplinary collaborations between industry, academia, and government.

The meeting will:

1. present and discuss the state of the art, recent breakthroughs, future directions, and technology needs for SHM,
2. foster relationships,
3. and showcase ongoing projects at Penn State.

**Center Mission:** Advance the state-of-the-art in structural health monitoring (SHM) to improve public safety, reduce maintenance costs, improve readiness, and foster a paradigm shift in design by leveraging and fostering collaborative R&D efforts between academia, industry, and government entities. Provide a means for transferring technology to member companies, agencies, and institutions.

[www.esm.psu.edu/shm](http://www.esm.psu.edu/shm) (click on 'Register for June 11-12 meeting')

## Special Speakers

### **Structural Health Monitoring of Nuclear Components, *Stephen E. Cumblidge, PNNL***

*(Thursday keynote)*

Dr. Cumblidge is a scientist at the Pacific Northwest National Laboratory. For the past seven years he has worked on issues facing the nuclear industry, including waste disposal and nondestructive testing of nuclear components. Current research with the Applied Physics Group involves determining the capabilities and reliability of nondestructive techniques to examine nuclear reactor components for the NRC. This research primarily involves the use of phased array and conventional ultrasound and includes techniques such as synthetic aperture focusing technique ultrasound (SAFT UT), eddy current, and visual testing. Additional research includes the use of acoustic emission and ultrasonic techniques for continuous online monitoring of nuclear power plant components. Previous research at PNNL included pressing and sintering pure uranium oxide fuel pellets and pellets doped with an array of elements designed to increase and decrease the lattice parameter and grain size of the fuel, using MCNP to explore advanced mixed-oxide nuclear fuel pellet configurations for enhanced plutonium elimination, and supporting the Yucca Mountain Geological Disposal Project.

### **Structural Health Monitoring - A GE Perspective, *Thomas J. Batzinger, GE (Friday keynote)***

Mr. Batzinger has 28 year experience in the development and application of Nondestructive Evaluation (NDE) technologies and is presently the Principal Engineer in the GE Global Research, Nondestructive Technologies Laboratory. His NDE experience started in the Nuclear Power Generation industry and has evolved to include efforts in the Aviation, Petrochemical, Transportation, Paper, and Power Generation industries. Mr. Batzinger received an Associate in Applied Science degree in the field of Nondestructive Testing from the State University of New York (Schenectady, New York), a Bachelor of Science in Mechanical Engineering Technologies from the University of Massachusetts (Lowell, MA) and a Master of Science in Mechanical Engineering from the Rensselaer Polytechnic Institute (Troy, New York). He presently has over 20 issued patents and numerous publications.

### **An Aviator's Perspective on Health Monitoring, *Gregory J. Johnson, ARL (Thursday dinner)***

Mr. Johnson is a research administrator at Penn State's Applied Research Laboratory. He works within the Materials and Manufacturing office, which oversees ARL's complex systems monitoring effort. Prior to joining ARL (18 years ago), Greg served as a Marine Corps aviator for 20 years. At the time of his retirement he was serving as an Executive Assistant to the Assistant Secretary of the Navy for Research, Development and Acquisition at the Pentagon. During his military career, Greg accumulated over 4300 hours of military flight time. Of that time, 2000 hours are in fixed wing aircraft; the rest is helicopter. Greg was a designated post-maintenance test pilot early in his career. He has worked in maintenance, operations, logistics, and acquisition. He has held all military flight designations, to include Weapons Tactics Instructor. He was the primary fixed wing instructor of the year at the Naval Air Training Command in Pensacola, Florida for 1979. The only accident he claims to have ever had was in his own home-built biplane; the result of a mechanic putting improper brake fluid in his brake system. A native of Southern California, Greg attended the University of Hawaii on a football scholarship. Following a short romance with the San Diego Chargers (as a free agent) he turned to Naval Aviation when he was finally able to pass the Navy's stringent aerospace flight physical. Greg holds a masters degree from Pepperdine University and is a graduate of the Defense Systems Management College. Tonight, Greg hopes to give you a journeyman's aviation perspective on health monitoring. He will also provide some anecdotal observations and insight on safety, as well as design for maintenance on aircraft. Following his comments he will field questions from the audience.

## Keynote Abstracts

### **Structural Health Monitoring of Nuclear Components, *S.E. Cumblidge, PNNL***

As the nuclear industry enters a new age of license extension for existing plants and construction of new reactors, the nondestructive testing methods used to assure the reliability of nuclear power plant components are being reexamined. Much has been learned about the materials degradation mechanisms in a nuclear power plant environment over the past several decades of operational experience. The current regulatory framework of periodic inspections of specified components has proven to be less than ideal for finding some forms of rapidly-propagating flaws such as stress corrosion cracking. Worldwide, a move from periodic maintenance to continuous online monitoring (COM) of some vulnerable components is being considered by some utilities and regulators. PNNL is working to help connect the future needs of the nuclear industry with the potential of COM for improving nuclear power plant safety.

Continuous online monitoring techniques have application in existing nuclear power plants that are being operated past their original 40-year license. Some of the components in these power plants are beginning to go beyond their original licensed lifetimes and may experience known forms of degradation in new places and new forms of slowly-initiating degradation. Continuous online monitoring for crack growth, leakage, and system reliability can be used to detect issues before the integrity of the plant is challenged and give real-time warnings about any problems that may exist.

For new reactor construction, COM can be used to monitor reliability issues common to newly-built complex systems. The new reactors under construction utilize new materials and new fabrication techniques, and may experience new forms of materials degradation. COM would be simpler to introduce in new construction, as the COM can be integrated into the construction as opposed to retrofit as with the existing nuclear power plants. Finally, COM may be a vital part of maintaining the Gen IV reactors currently being designed. As component test facilities are planned and built, now is an ideal time to integrate COM technologies into the design to allow for performance testing and future monitoring of the Gen IV reactors when they are constructed. Challenges facing COM include integrating the new inspection methodology into the regulatory structure and into the corporate culture of the utilities. While many COM technologies are being developed for a variety of industries, little direct work is being performed to adapt the COM technologies to the special conditions common to the nuclear industry. The Sustainable Nuclear Power Initiative (SNPI) is expanding PNNL's experience with acoustic emission and other ultrasonic techniques. The Proactive Management of Materials Degradation (PMMD) program, funded through the NRC, is exploring the regulatory side of evaluating the effectiveness of new NDE methods, including COM techniques.

### **Structural Health Monitoring - A GE Perspective, *T.J. Batzinger***

Studies have shown that the cost of corrosion to the infrastructure is almost 3% of US GDP. GE has a history of supplying technology to the Aviation, Power Generation, Oil and Gas and Transportation industries. We will describe structural health topics facing our customers in these industries with a detailed discussion on key infrastructure issues. Additionally, we will discuss new technologies developed at GE Global Research enabling key structural health monitoring for an aviation and petrochemical industry application. The presentation will conclude with future directions to consider as the team develops new technology for Structural Health Monitoring.



**Center of Excellence in Structural Health Monitoring**  
**Spring Meeting, Penn Stater Conference Center, University Park, PA**  
**Thursday, 11 June 2009**

8:30	Registration and Coffee
9:00	<b>Welcome</b> by <a href="#">Judith Todd</a> , Penn State Engineering Science and Mechanics <b>Introduction</b> by <a href="#">Cliff Lissenden</a> , Penn State Engng. Science & Mech.
9:15	<b>Keynote: Structural Health Monitoring of Nuclear Components</b> , <a href="#">Stephen Cumblidge</a> , <i>Pacific Northwest National Laboratory</i>
10:05	<b>Model-Based Structural Health Monitoring</b> , <a href="#">Karl Reichard</a> , <i>Penn State Applied Research Laboratory</i>
10:30	Break
10:50	<b>Rotorcraft Airframe Structural Integrity Monitoring</b> , <a href="#">Mark Davis</a> , <i>Sikorsky Aircraft</i>
11:15	<b>Vibration-Based Structural Damage Detection</b> , <a href="#">Weidong Zhu</a> , <i>University of Maryland-Baltimore County</i>
11:40	<b>Ultrasonic Guided Wave Technology Transfer</b> , <a href="#">Steve Owens</a> and <a href="#">Roger Royer</a> , <i>FBS Inc.</i>
12:05	Lunch
1:15	<b>SHM Center Update</b> , <a href="#">Cliff Lissenden</a> , <i>Penn State Engineering Science and Mechanics</i>
1:35	<b>Aircraft Aging and Durability Project Overview</b> , <a href="#">Elliott Cramer</a> , <i>NASA Langley Research Center</i>
2:00	<b>Energy Harvesting</b> , <a href="#">Heath Hofmann</a> , <i>Penn State Electrical Engineering</i>
2:25	<b>Wireless Ultrasonic Transducer Network for SHM Applications</b> , <a href="#">George Zhao</a> , <i>Intelligent Automation Inc.</i>
2:50	Posters and Displays with Snacks (DirectMeasurements, NI)
3:30	Panel-Led Discussion (Cumblidge, Batzinger, Perez, Sharma)
4:00	Penn State Facilities (visit labs in Earth-Engineering Sciences Bldg)
6:00	Reception
6:30	Dinner with Speaker, <a href="#">Greg Johnson</a> , <i>Penn State Applied Research Laboratory</i> , <b>An Aviator's Perspective on Health Monitoring</b>





**Center of Excellence in Structural Health Monitoring**  
**Spring Meeting, Penn Stater Conference Center, University Park, PA**  
**Friday, 12 June 2009**

8:30	Registration and Coffee
9:00	<b>Keynote: Structural Health Monitoring - A GE Perspective</b> , <a href="#">Thomas Batzinger</a> , <i>GE Global Research</i>
9:50	<b>Coupled-Field Modeling and Simulation of Damage Dynamics and Failure Statistics</b> , <a href="#">Joseph Cusumano</a> and <a href="#">Francesco Costanzo</a> , <i>Penn State Engineering Science and Mechanics</i>
10:15	<b>SHM Sensing and Embedded Monitoring Devices</b> , <a href="#">Bill Nickerson</a> , <i>Impact RLW Systems</i>
10:40	Break
11:00	<b>Using COTS Technology to Create a New Generation of Structural Health Monitoring Systems</b> , <a href="#">Igor Alvarado</a> , <i>National Instruments</i>
11:25	<b>New Sensors for Improved Ultrasonic Guided Wave Tomography in SHM</b> , <a href="#">Joseph Rose</a> , <i>Penn State Engineering Science and Mechanics</i>
11:50	Lunch
1:00	<b>SHM and NDI Technologies for Wind Energy Structures</b> , <a href="#">Clark Moose</a> , <i>Penn State Applied Research Laboratory</i>
1:25	<b>Health Monitoring &amp; Management (HMM) Industry Benchmarking</b> , <a href="#">Ronald Treusdell</a> , <i>Booz Allen Hamilton</i>
1:50	<b>Probabilistic Fatigue Life Prediction from Guided Wave Ultrasonic Technology SHM</b> , <a href="#">Cliff Lissenden</a> , <i>Penn State Engineering Science and Mechanics</i>
2:15	<b>Penn State-led NSF ERC Proposal on Ultrasound Tool Sets for Health and Infrastructure</b> , <a href="#">Tom Shrout</a> , <i>Penn State Materials Research Institute</i>
2:40	Wrap-up
3:00	Advisory Board Meeting



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Sensing & Inspection Technologies

**SIEMENS**