phmsociety

PHM 2010

Annual Conference of the Prognostics and Health Management Society

October 10-14
Portland, Oregon, USA

Portland Hilton & Executive Towers

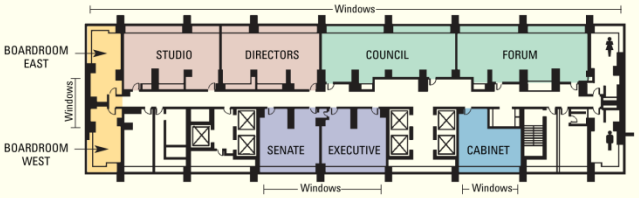
Held Concurrently with
DX 2010
21st International Workshop on the Principles of Diagnosis
October 13-16

www.phmsociety.org

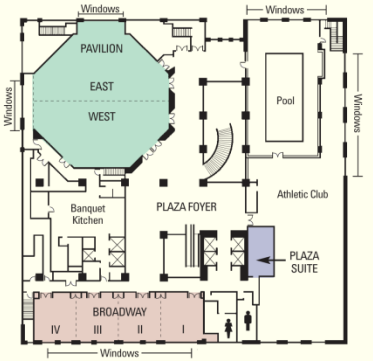
Hotel Function Space

Hilton
Portland & Executive Tower

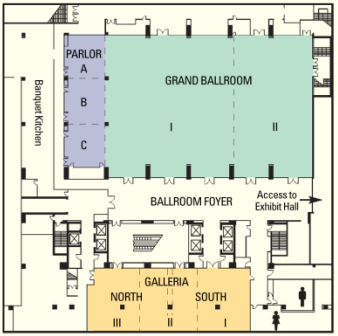
3RD FLOOR CONFERENCE LEVEL



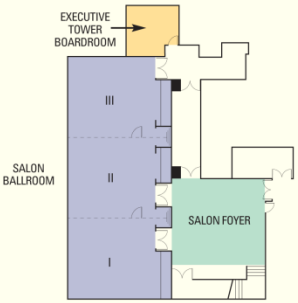
PLAZA LEVEL



BALLROOM LEVEL



HILTON PORTLAND EXECUTIVE TOWER



The Conference

The Prognostics and Health Management Society (PHM Society) welcomes you to its annual international conference. The 2010 PHM Society Conference brings together the global community of PHM experts from industry, academia, and government in diverse application areas such as energy, aerospace, transportation, automotive, and industrial automation. The conference features panel discussions, hands-on demonstrations, a luminaries session, a dedicated session on fielded systems, a doctoral symposium, and a full day of tutorials free to all registrants. Results from the PHM data analysis competition will be discussed. Leading companies and research institutions will exhibit their products and demonstrate their technologies during the event. Several social events will provide opportunities for participants to connect with colleagues.

The PHM Society

For years, the field of PHM was represented under a variety of banners, including aerospace, reliability, failure analysis and prevention, mechanical engineering, and others. Nevertheless, PHM is broader than any single field of engineering. The PHM Society was established in order to unite the fragmented PHM community and to establish PHM as a legitimate scientific and engineering discipline that draws from electrical, mechanical, civil, and chemical engineering, computer and materials science, reliability, test and measurement, artificial intelligence, physics, and economics. We invite you to establish PHM as a meta-discipline that draws from electrical, electronics, mechanical, civil, and chemical engineering, computer and materials science, reliability, test and measurement, artificial intelligence, physics, and economics.

What Sets this Conference Apart

A major differentiator for the PHM Society is its contemporary approach toward copyright: the Society does not take ownership of your work! Instead, authors retain copyright through a Creative Commons License while allowing the PHM Society to distribute their work broadly through modern media. As a result, your original articles will reach the entire world for free and without access restrictions.

The conference invites original, high-quality contributions submitted as full-length papers. Each paper is reviewed by up to four experts in the field based on the criteria of originality, significance, quality, and clarity. The conference proceedings are published on the web for unrestricted access by the global scholarly community, thus maximizing the dissemination and impact of your original work.

Doctoral Symposium

The Doctoral Symposium provides an opportunity for students to present their research interests and obtain guidance from a panel of distinguished researchers as well as comments from fellow students.

The PHM Society Doctoral Symposium will be held as a workshop on Sunday October 10, 2010. In order to allow sufficient time for discussions, the organizing committee has invited a limited number of students to participate. Students presenting at the Doctoral Symposium are also invited to present a poster of their research at the conference and their thesis abstract will appear in the conference proceedings. All students are invited to attend the Doctoral Symposium even if they are not interested in presenting their work.

Luminaries Session

The PHM Society is excited to announce the 2nd Annual Luminaries Session on Prognostics to be held on Wednesday, October 13, 2010. Three experts from radically different domains will challenge your perspectives on Prognosis and provide you with new insight on how to face the abundance of challenges in the PHM/CBM community. A compilation of Prognosticators representing the Engineering & Actuarial Science, Financial Risk Management and Technosocial Predictive Analytics domains will each give a keynote speech followed by an engaging Panel Session.

Presenters:

Understanding PHM's Business Value – an "Actuarial Engineering" Perspective

Dr. Sameer Vittal
Engineering/Actuarial Science
Sameer Vittal, Ph.D. is the Technical Leader (Analytics) at GE Energy's Advanced Technology Operations (ATO), located in Atlanta, GA. In this role, Sameer leads multiple global teams tasked with developing PHM technologies and asset management solutions for GE Energy's portfolio of thermal power plants, wind turbines and industrial solutions. Sameer has a BE in Mechanical Engineering from Bangalore University, India and an MS and PhD in Mechanical Engineering from Rensselaer Polytechnic Institute, NY. He joined GE in 2000 as a reliability engineer and subsequently led the development of GE Energy's Gas Turbine CBM department before joining the ATO.

Sameer's research interests are focused on reliability engineering, probabilistic design & optimization, condition monitoring, PHM, financial risk management and actuarial science. In addition to driving technical innovation in PHM, he is also focused on developing the "business" of PHM – from business case development and value modeling to the integration of PHM with stochastic risk and portfolio management technologies. Many of these hybrid "actuarial engineering" approaches are now used in modeling and managing the risk of extended warranties and long-term service agreements.

Models for Credit Risk in a Network Economy

Dr. Henry Schellhorn
Financial Rick Management
Dr. Henry Schellhorn is associate professor of mathematics and co-director of the financial engineering program at Claremont Graduate University. Before holding this position he was assistant professor of finance at the University of Lausanne, Switzerland. He also worked in industry for about 10 years in various capacities, as management consultant first and then research engineer in the financial software industry. Dr. Schellhorn holds a Ph.D. in operations research from UCLA. His current research interests are credit risk, portfolio optimization, and American option pricing.

Technosocial Predictive Analytics: Creating Decision Advantage through the Integration of Human Physical Models

Dr. Antonio Sanfilippo
Technosocial Predictive Analytics
Dr. Antonio Sanfilippo is Chief Scientist in the Computational and Statistical Analytics Division at Pacific Northwest National Laboratory (PNNL). His research focus is on Computational Linguistics, Content Analysis, Knowledge Technologies and Predictive Analytics with reference to cognitive, social, behavioral and biomedical sciences. He is currently leading a multi-year Laboratory Initiative on Technosocial Predictive Analytics at PNNL and a five-year grant from the National Institutes of Health on pathway prediction, and co-leading a 3-year grant from the National Science Foundation on developing models of science policy. During 2004 and 2005, Dr. Sanfilippo headed a multi-laboratory consortium which led the establishment of the Motivation and Intent thrust area within the Department of Homeland Security. Prior posts include: R&D director at Textology Inc., SRA International, and LingoMotors Inc.; senior consultant at the European Commission; research supervisor and group manager at SHARP Laboratories of Europe; research associate at the University of Edinburgh and the University of Cambridge in the UK. Dr. Sanfilippo holds a M.A. and M. Phil. degrees in Anthropological Linguistics from Columbia University, and a Ph.D. in Cognitive Science from the University of Edinburgh.

Fielded Systems

The 2010 Conference will once again feature the ever-popular Fielded Systems Session. In this session, invited speakers will discuss their experience with fielded PHM solutions. A fielded system is one that has left the prototype stage and that has been in active use over a long period of time for a sizable number of units (where "sizable" depends on the application domain). The emphasis is on sharing lessons learned, both good and bad. The lectures will provide interesting insights into what the value proposition was, which corrections had to be made, what some of the shortcomings were, and what the user reaction was (and, in addition, some anecdotal notes). These insights might provide a calibration point for transitioning PHM solutions, and they might provide ideas for future research.

Data Analysis Competition

The PHM Data Challenge is a competition open to all potential conference attendees. This year the challenge was focused on machine tool wear prediction.

Participants were scored based on their ability to correctly estimate wear characteristics of the machine tool system. Winners of the Student and the Professional categories will be recognized with a cash prize. Top scoring participants will present their solutions at a special session of the conference.

Exhibits

The following companies will exhibit at the conference:

Booth #: Company Name

1: PHM Technology
2: National Instruments
3: Frontier Technology, Inc.
4: Global Tech Connection
5: Goodrich
6: HBM, Inc. nCode Products
7: SAE International
8: Metis Design
9: NASA
10: Impact Technologies
11: Northrop Grumman
12: R.K. Diagnostics
13: Management Sciences, Inc.
14: Ridgetop Group

Please refer to the exhibits floor plan on page 18 for details on booth locations.

Hardware Demonstrations

Selected participants will present their diagnostic and prognostic engineering approaches as PHM demonstrations at the Conference. Experienced professionals will share their engineering techniques to solve health management problems with the rest of the PHM community. The concept of the PHM demonstrations is to promote a hands-on learning experience for all attendees.

The hardware and/or software PHM demonstrations will be given as hands-on tutorials to small groups. Each hands-on tutorial will last for approximately 30 minutes where attendees will be allowed to ask questions. Interested participants may sign up for demonstrations onsite at the registration desk.

Hardware Demonstration Schedule

Tuesday, October 12, 2010			
Flyable Electro-mechanical Actuator (FLEA) Test Bed	*Edward Balaban (NASA Ames)*	Galleria South	8:30-9:15am
Constellation Ground Ops FDIR	*Jose Perotti (NASA KSC)*	Galleria South	9:15-10:00am
CBMi™ Sentyre™ - Wireless Portable Vibration Diagnostic System	*Bill Nickerson (Impact-RLW Sys.)*	Galleria South	10:30-11:15am
Vibration Based Diagnostic Systems	*Renata Klein / Jerome Lacaille (R.K. Diagnostics /Snecma)*	Galleria South	11:15-12noon
Mixed Mode Army Stryker PHM Demo	*Kenneth Blemel (Management Sciences, Inc.)*	Galleria South	1:30-2:15pm
Laboratorial Demonstration of PRODDIA™	*Gustavo R. Dias /Julio Viana (Critical Materials)*	Galleria South	2:15-3:00pm
Wednesday, October 13, 2010			
CBMi™ Sentyre™ - Wireless Portable Vibration Diagnostic System	*Bill Nickerson (Impact-RLW Sys.)*	Galleria South	1:30-2:15pm
Laboratorial Demonstration of PRODDIA™	*Gustavo R. Dias/Julio Viana (Critical Materials)*	Galleria South	2:15-3:00pm
Flyable Electro-mechanical Actuator (FLEA) Test Bed	*Edward Balaban (NASA Ames)*	Galleria South	3:30-4:15pm
Constellation Ground Ops FDIR	*Jose Perotti (NASA KSC)*	Galleria South	4:15-5:00pm
Thursday, October 14, 2010			
Mixed Mode Army Stryker PHM Demo	*Kenneth Blemel (Management Sciences, Inc.)*	Galleria South	8:00-8:45am
Vibration Based Diagnostic Systems	*Renata Klein / Jerome Lacaille (R.K. Diagnostics /Snecma)*	Galleria South	8:45-9:30am

Tutorials

The tutorials will give both experienced practitioners as well as newcomers insightful information into state of the art health management techniques. The tutorials will run all day Monday and are free of charge to all registrants. They cover basic aspects of diagnostics and prognostics, go into how PHM connects with logistics and explain cost-benefit calculations, and discuss how to use component health information to reconfigure systems on the fly. In addition, advanced subjects such as software health management and verification and validation will be covered.

Tutorial 1A: Introduction to Diagnostics
Monday, 8:00am – 9:50am

Greg Kacprzynski, Director, Engineering Services at Impact Technologies

Greg Kacprzynski is Director of Engineering Services and co-founder of Impact Technologies, LLC. Greg directs engineering teams that develop software and provide consulting support associated with system health management including diagnostic, prognostic and reasoning technologies, physics of failure modeling, intelligent control, and maintenance optimization. In his 15 years of experience in this domain, Greg has been technical lead on a wide variety of PHM/CBM related programs for both DoD and commercial applications and published more than 25 papers and journal articles. His education was at Rochester Institute of Technology (BS/MS) in Mechanical Engineering.

Tutorial 1B: Information Fusion for PHM Models (Anomaly Detection, Diagnostics, & Prognostics)
Monday, 8:00am – 9:50am

Piero P. Bonissone, Chief Scientist, GE Global Research

A Chief Scientist at GE Global Research, Dr. Bonissone has been a pioneer in the field of fuzzy logic, AI, soft computing, and approximate reasoning systems applications since 1979. He is a Fellow of IEEE, AAAI, IFSA, and a Coolidge Fellow at GE Global Research. He served as Editor in Chief of the International Journal of Approximate Reasoning for 13 years. He has co-edited six books and has over 150 publications. He received 50 patents issued from the USPTO (plus 51 pending). He has (co-)chaired 12 scientific conferences and symposia focused on Multi-Criteria Decision-Making, Fuzzy sets, Diagnostics, Prognostics, and Uncertainty Management in AI. In 2002, he was President of the IEEE Neural Networks Society (now Computational Intelligence Society). He has been an Executive Committee member of NNC/NNS/CIS society since the past 16 years and an IEEE CIS Distinguished Lecturer since 2004.

Tutorial 2A: Introduction to Prognostics
Monday, 10:10am – 12noon

Abhinav Saxena, Research Scientist, SGT at NASA Ames Research Center

Abhinav Saxena is a Research Scientist with SGT Inc. at the Prognostics Center of Excellence NASA Ames Research Center, Moffett Field, CA. His research involves developing prognostic algorithms and methodologies to standardize prognostics that include performance evaluation and requirement specification for prognostics of engineering systems. He has been involved in PHM research for the last seven years and has published several papers on these topics. He is a PhD in Electrical and Computer Engineering from Georgia Institute of Technology, Atlanta. He earned his B. Tech. in 2001 from Indian Institute of Technology (IIT) Delhi, and a Masters Degree from Georgia Tech in 2003.

Tutorial 2B: Uncertainty Management in Prognostics
Monday, 10:10am – 12noon

Yongming Liu, Assistant Professor, Department of Civil and Environmental Engineering, Clarkson University

Dr. Yongming Liu is an assistant Professor in the department of civil and environmental engineering at Clarkson University. His research interests include fatigue and fracture analysis of metals and composite materials, probabilistic methods, computational mechanics, and risk management. He completed his PhD at Vanderbilt University, and obtained his Bachelors' and Masters' degrees from Tongji University in China. Dr. Liu is a

member of ASCE and AIAA and serves on several technical committees on probabilistic methods and advanced materials. His group is current working on several projects for probabilistic prognosis sponsored by NASA, NSF, and FAA.

Tutorial 3: Accelerated Life Testing (ALT) in Electronics
Monday, 1:30pm – 3:00pm

Ephraim Suhir, Professor, Dept. of Electrical Engineering, UC Santa Cruz
Dr. Suhir is Distinguished Member of Technical Staff (ret), Basic Research Area, Bell Labs, Murray Hill, NJ. He is currently on the faculty of the Electrical Engineering Department, University of California, Santa Cruz, CA. He is also serving as a Visiting Professor, Department of Mechanical Engineering, at the University of Maryland, College Park, MD. He is also CEO of ERS Reliability Engineering Co. Dr. Suhir is Foreign Full Member (Academician) of the National Academy of Engineering, Ukraine, and Fellow of the Institute of Electrical and Electronics Engineers (IEEE), the American Physical Society (APS), the American Society of Mechanical Engineers (ASME), the Institute of Physics (IoP), UK, and the Society of Plastics Engineers (SPE). He has authored about 300 technical publications (patents, papers, book chapters, books). He received many professional awards from ASME, IMAPS, IEEE and Bell Laboratories.

Tutorial 4: Verification & Validation for PHM
Monday, 3:00pm – 5:00pm

Guillaume Brat, Ph.D., NASA Ames Research Center
Dr. Brat received his M.Sc. and Ph.D. in Electrical & Computer Engineering from The University of Texas at Austin. He is the deputy area lead for the Robust Software Engineering group at the NASA Ames Research Center; he focuses on research and application of sound and complete static analysis (based on abstract interpretation) to the verification of large software systems. He also serves as the Principal Scientist on the V&V of Flight Critical Systems effort (funded under the Aviation Safety program in NASA ARMD), which conducts research in V&V techniques for Aerospace systems, including PHM applications.

Agenda

Sunday, October 10, 2010			Location	Times
Registration			**Plaza Foyer**	**7:00am–5:00pm**
Continental Breakfast			Plaza Foyer East	7:00-8:00am
Doctoral Symposium Session	**J. Bird/ S. Letourneau (Co-Chairs)**	NRC (Canada)	**Pavilion Ballroom East**	**8:00-5:00pm**
Willamette Valley Wine Tasting Tour			Meet in Hotel Lobby	12noon-5:00pm

Monday, October 11, 2010			Location	Times
Registration			**Plaza Foyer**	**7:00am–5:00pm**
Continental Breakfast (Sponsored by Xerox)			Grand Ballroom Foyer	7:00-8:00am
Tutorial Sessions	**Kai Goebel (Chair)**	*NASA Ames*		
Tutorial Session 1A: Introduction to Diagnostics	**Greg Kacprzynski**	*Impact Technologies*	**Parlor**	**8:00-9:50am**
Tutorial Session 1B: Information Fusion for PHM Models	**Piero Bonissone**	*GE Global Research*	**Grand Ballroom II**	**8:00-9:50pm**
Coffee Break (Sponsored by Global Strategic Solutions, Inc.)			Grand Ballroom Foyer	9:50-10:00am
Tutorial Session 2A: Introduction to Prognostics	**Abhinav Saxena**	*SGT at NASA Ames*	**Parlor**	**10:10-12noon**
Tutorial Session 2B: Uncertainty Management in Prognostics	**Yongming Liu**	*Clarkson University*	**Grand Ballroom II**	**10:10-12noon**
Lunch (Sponsored by Frontier Technology, Inc.)			Grand Ballroom I	12noon-1:30pm
Tutorial Session 3: Accelerated Life Testing in Electronics	**Ephraim Suhir**	*University of California, Santa Cruz*	**Grand Ballroom II**	**1:30-3:00pm**
Coffee Break (Sponsored by Global Strategic Solutions, Inc.)			Grand Ballroom Foyer	3:00-3:30pm
Tutorial Session 4: Verification & Validation for PHM	**Guillaume Brat**	*NASA Ames*	**Grand Ballroom II**	**3:30-5:00pm**
Hardware Demo Setup			Galleria South	1:00-5:00pm
Exhibitor Setup			Pavilion	12noon-5:00pm
Welcome Reception & Exhibits (Sponsored by Goodrich)			**Plaza Foyer & Pavilion**	**5:30-7:30pm**

Tuesday, October 12, 2010			Location	Times
Registration			**Plaza Foyer**	**7:00am–5:00pm**
Continental Breakfast (Sponsored by Global Technology Connection)			Grand Ballroom Foyer	7:00-8:00am
Exhibits			**Pavilion**	**8:00-4:00pm**
Opening Remarks	**Mike Roemer /Serdar Uckun**	*General Chair/ President PHM Society*	**Grand Ballroom I**	**8:00-8:30am**
Hardware Demos			**Galleria South**	**8:30-5:30pm**
Paper Session 1A: Diagnostic Methods	**Ian Jennions (Chair)**	*Cranfield University, IVHM Ctr.*	**Galleria North**	**8:30-10:00am**
A Three Dimensional Receiver Operator Characteristic Surface Diagnostic Metric	*D. Simon*	*NASA Glenn*		
Stage Separation Failure: Model Based Diagnostics and Prognostics	*D. G. Luchinsky, V. Hafiychuk, I. Kulikov, et. al.*	*NASA Ames /NASA Marshall Space Flight Ctr.*		
Model-Based Assurance of Diagnostic Procedures for Complex Systems	*T. Kurtoglu, R. Lutz, M. S. Feather*	*MCT/Jet Propulsion Lab/Caltech*		
Paper Session 1B: Electronic Prognostics	**Sony Mathew (Chair)**	*CALCE – University of Maryland*	**Grand Ballroom II**	**8:30-10:00am**
Turn-off Time as a Precursor for Gate Bipolar Transistor Latch-up Faults in Electric Motor Drives	*G. Vachtsevanos, M. Abbas, D. Brown, et. al.*	*GeorgiaTech /Impact Technologies*		
An Adaptive Recurrent Neural Network for Remaining Useful Life Prediction of Lithium-ion Batteries	*P. J. Liu, A. Saxena, K. Goebel, B. Saha, W. Wang*	*Carleton Univ./ Stinger Ghaffarian Technologies/ MCT/ Lakehead University*		
Towards Modeling the Effects of Lightning Injection on Power MOSFETs	*S. Saha, J. Celaya, B. Saha, P. Wysocki, et. al.*	*MCT/NASA Ames/SGT/ASRC Aerospace Corp.*		
Paper Session 1C: Control & Uncertainty with PHM	**George Vachtsevanos (Chair)**	*GeorgiaTech*	**Parlor**	**8:30-10:00am**
Fault Adaptive Control of Overactuated Systems Using Prognostic Estimation	*B.M. Bole, D. Brown, H. Pei, K. Goebel, G. Vachtsevanos*	*GeorgiaTech / South China Univ. of Tech./ NASA Ames/ Impact Technologies*		
Emerging Challenges and Technologies in Signal Processing for Prognostics and Health Management in Wind Energy	*P. Johnson*	*National Instruments*		
Impact of Input Uncertainty on Failure Prognostic Algorithms: Extending the Remaining Useful Life of Nonlinear Systems	*D. Edwards, M. Orchard, L. Tang, K. Goebel, G. Vachtsevanos*	*GeorgiaTech/ Universidad de Chile/Impact Technologies/ NASA Ames*		

Tuesday, October 12, 2010			Location	Times
Energy Workshop Session 1	**Shawn Sheng (Chair)**	*NREL*	**Broadway Room**	**8:30-10:00am**
A multi-mode structural health monitoring system for wind turbine blades and components	*R.B. Owen, D.J. Inman, D.S. Ha*	*Extreme Diagnostics, Inc./ Virginia Polytechnic Institute*		
Application of Oil Debris Monitoring for Wind Turbine Gearbox Prognostics and Health Management	*R. Dupuis*	*GasTOPS*		
Detection of Precursors to Component Failure in a Spur Gear Drive-Train by Means of a Torque Transducer	*J. Yutzy, C. Bruns, N. Yoder, D. Adams*	*Purdue University*		
Coffee Break (Sponsored by Rockwell Collins)			Pavilion	10:00-10:30am
Paper Session 2A: Helicopter/Gear PHM I	**Praneet Menon (Chair)**	*Goodrich*	**Galleria North**	**10:30-12noon**
Effectiveness of Empirical Mode Decomposition Based Features Compared to Kurtosis Based Features for Diagnosis of Pinion Crack Detection in a Helicopter	*C. Ly, K. I. Ranney, K.F. Tom, H.C. Khatri, H. J. Decker*	*U.S. Army Research Laboratory*		
Gear Fault Location Detection for Split Torque Gearbox using AE Sensors	*D. He, P. Menon, R. Li, S. Seçkiner, E. Bechhoefer*	*Univ. of Illinois-Chicago/ Goodrich/ University of Gaziantep/ NRG Systems*		
Gear and bearing fault detection under variable operating conditions	*P. Boškoski, D. Juričić, and M. Stankovski*	*Jožef Stefan Institute/ University Ss. Cyril & Methodius*		
Paper Session 2B: Analytical PHM Methods I	**Ignacio Perez (Chair)**	*ONR*	**Grand Ballroom II**	**10:30-12noon**
Complex System Fault Detection Using Factor Analysis	*Y. Zhang*	*GM R&D Center*		
Trans-dimensional MCMC for Fatigue Prognosis Model Determination, Updating, and Averaging	*X. Guan, R. Jha, Y. Liu*	*Clarkson University*		
Combination of Analytical and Statistical Models for Dynamic Systems Fault Diagnosis	*A. Bregon, D. Garcia-Alvarez, B. Pulido, M. J. Fuente*	*University of Valladolid (Spain)*		
Session 2C: PHM Data Challenge and Results	**Neil Eklund (Chair)**	*GE Global Research*	**Parlor**	**10:30-12noon**
PHM Challenge Problem Winning Approach – Professional Division	*Team "gtl-phm" (Sreerupa Das & Gregory Harrison)*	*Lockheed Martin*		
PHM Challenge Problem *Runner-up*- Professional Division	*Huimin Chen Associate Professor*	*University of New Orleans*		
Challenge Problem Winning Approach – Student Division	*"PathFinder" (Gang Liu)*	*University of New Orleans*		

Tuesday, October 12, 2010			Location	Times
Energy Workshop Session 2	**Eric Bechhoefer (Chair)**	*NRG Systems, Inc.*	**Broadway Room**	**10:30-12noon**
Prognosis - Subsea Oil and Gas Industry	*P. Vaidya*	*Dept. of Production & Quality Engineering, NTNU (Norway)*		
Remote Health Monitoring For Offshore Machines, Using Fully Automated Vibration Monitoring And Diagnostics	*M. Mjit, P.J. Beaujean, D. J. Vendittis*	*Florida Atlantic University*		
Learning Decision Rules by Particle Swarm Optimization (PSO) for Wind Turbine Fault Diagnosis	*X. Ye, Y. Yan, L. Osadciw*	*Syracuse University/Arcon Corp./Sensis Corp.*		
Lunch Break (Attendees on Own)				12noon-1:30pm
Paper Session 3A: Materials PHM I	**Giovanni Jacazio (Chair)**	*Politecnico di Torino*	**Galleria North**	**1:30-3:00pm**
Fabrication of a Multi-Physics Integral Structural Diagnostic System Utilizing Nano-Engineered Materials	*S. Kessler, A. Raghavan, C.T. Dunn, R.Guzman deVilloria, et. al.*	*Metis Design Corporation/MIT*		
Remaining Life Prognostics for a Multiaxial Fatigue Case on an Army Ground Vehicle System	*R. Heine, D. Barker*	*United States Army Materiel Systems/ University of Maryland*		
Structural fatigue prognosis using limited sensor data	*J. He, Y. Liu*	*Clarkson University*		
Paper Session 3B: Anomaly Detection I	**Nicholas Propes (Chair)**	*GTC*	**Grand Ballroom II**	**1:30-3:00pm**
Data-Driven Anomaly Detection Performance for the Ares I-X Ground Diagnostic Prototype	*R. Martin, M. Schwabacher, B.Matthews*	*NASA Ames /Stinger Ghaffarian Technologies*		
An Adaptive Anomaly Detector used in Turbofan Test Cell	*J. Lacaille, V. Gerez, R. Zouari*	*Snecma /Safran Engineering Services (France)*		
A Hybrid-Logic Approach Towards Fault Detection in Complex Cyber-Physical Systems	*N. Srivastava, J. Srivastava*	*University of Minnesota*		
Paper Session 3C: Design for PHM	**Ginger Shao (Chair)**	*Honeywell*	**Parlor**	**1:30-3:00pm**
A "Design for Availability" Approach for Use with PHM	*T. Jazouli, P. Sandborn*	*CALCE University of Maryland*		
Reliability Based Design Recommendations for an Electromechanical Actuator Test Stand	*M.T. Koopmans, R.C. Hooven, I.Y. Tumer*	*Oregon State University*		
Towards Defining and Allocating PHM Requirements for Military Systems	*J. Luna*	*Frontier Technology, Inc.*		

Tuesday, October 12, 2010			Location	Times
Energy Workshop Session 3	**Shawn Sheng & Eric Bechhoefer (Co-Chairs)**	*NREL/NRG Systems, Inc.*	**Broadway Room**	**1:30-3:00pm**
Adaptive Monitoring, Fault Detection and Diagnostics, and Prognostics System for the IRIS Nuclear Plant	*J.Coble, M. Humberstone, J. W. Hines*	*University of Tennessee*		
Energy Workshop Discussion	*S. Sheng & E. Bechhoefer (Co-Chairs)*	*NREL/ NRG Systems, Inc.*		
Coffee Break (Sponsored by Rockwell Collins)			Pavilion	3:00-3:30pm
Panel/Workshop Session A: Education	**Karl Reichard**	*Penn State ARL*	**Galleria North**	**3:30-5:00pm**
Panel/Workshop Session B: Certifying Software For Engine Health Management Systems: Current And Future States	**Ravi Rajamani**	*P&W*	**Grand Ballroom II**	**3:30-5:00pm**
Panel Participants	*G. Iverson, H. Larsen, C. Queitzsch, R. Rajamani, D. Simon , N. Waters*	*Boeing/FAA/ Pratt & Whitney /NASA Glenn/ Rolls Royce*		
Panel/Workshop Session C: CBM and Enterprise Health Management	**Andy Hess & Luis Hernandez**	*Hess PHM Group & GSS*	**Parlor**	**3:30-5:00pm**
Poster Reception (Sponsored by SAE International)			**Plaza Foyer & Pavilion**	**5:30- 8:00pm**

Wednesday, October 13, 2010			Location	Times
Registration			**Plaza Foyer**	**7:00am-5:00pm**
Continental Breakfast (Sponsored by NASA)			Grand Ballroom Foyer	7:00-8:00am
Luminaries Session (Sponsored by Impact Technologies)			**Grand Ballroom I**	**8:30-11:00am**
Luminaries Session Assembly & Introduction	**Greg Kacprzynski (Chair)**	*Impact Technologies*	**Grand Ballroom I**	**8:30-8:45am**
Understanding PHM's Business Value – An "Actuarial Engineering" Perspective	**Dr. Sameer Vittal**	*GE Energy*	**Grand Ballroom I**	**8:45-9:15am**
Models for Credit Risk in a Network Economy	**Dr. Henry Schellhorn**	*Claremont University*	**Grand Ballroom I**	**9:15-9:45am**

Wednesday, October 13, 2010			Location	Times
Percolation Break: Coffee and Refreshments (Sponsored by BAE Systems)			Grand Ballroom Foyer	9:45-10:00am
Technosocial Predictive Analytics: Creating Decision Advantage through the Integration of Human and Physical Models	**Dr. Antonio Sanfilippo**	*Pacific Northwest National Lab*	**Grand Ballroom I**	**10:00-10:30am**
Plenary Session	**All Participants**		**Grand Ballroom I**	**10:30-11:00am**
Best Papers & Data Challenge Awards (Sponsored by PARC)			**Grand Ballroom I**	**11:00-12noon**
Data Challenge Awards Presentation	**Neil Eklund**	*GE Global Research*	**Grand Ballroom I**	**11:00-11:30am**
Best Paper Awards Presentation	**Karl Reichard**	*Penn State ARL*	**Grand Ballroom I**	**11:30-12noon**
Exhibits			**Pavilion**	**12noon-4:30pm**
Lunch Break (Attendees on Own)				12noon-1:30pm
Hardware Demos			**Galleria South**	**1:30-4:30pm**
Paper Session 4A: Prognostic Methods I	**Duncan Chase (Chair)**	*Rolls Royce*	**Grand Ballroom II**	**1:30–3:00pm**
A State-Space Model for Vibration Based Prognostics	*E. Bechhoefer, S. Clark, D. He*	*NRG Systems/ Univ. of Illinois-Chicago*		
Efficient probabilistic methods for real-time fatigue damage prognosis	*Y. Xiang, Y. Liu*	*Clarkson University*		
Health Monitoring of a Pneumatic Valve Using a PIT Based Technique	*J. P. P. Gomes, B.C. Ferreira, D. Cabral, R. K. H. Glavão & T. Yoneyama*	*Embraer/ ITA – Instituto Tecnológico de Aeronáutica*		
Paper Session 4B: Machine Tool PHM I	**Chris Pomfret (Chair)**	*Treble One*	**Galleria North**	**1:30–3:00pm**
Prognostics with Autoregressive Moving Average for Railway Turnouts	*I. Jennions, A. Guclu, H. Yilboga, O. Faruk Eker, F. Camci*	*Cranfield Univ. (UK)/ Fatih University Buyukcekmece/ Meliksah Univ. (Turkey)*		
Advanced diagnostics of position sensors for the actuation systems of high-speed tilting trains	*G. Jacazio, D. Risso, M. Sorli, L. Tomassini*	*Politecnico of Turin/ Microtecnica (Italy)*		
Machine Remaining Useful Life Prediction Based on Adaptive Neuro-Fuzzy and High-Order Particle Filtering	*C. Chen, G. Vachtsevanos, M. E. Orchard*	*GeorgiaTech/ Universidad de Chile (Chile)*		
Coffee Break (Sponsored by BAE Systems)			Pavilion	3:00-3:30pm

Wednesday, October 13, 2010			Location	Times
Paper Session 5A: Helicopter/Gear PHM II	**Ash Thakker (Chair)**	*GTC*	**Grand Ballroom II**	**3:30-5:00pm**
Probabilistic Latent Component Analysis for Gearbox Vibration Source Separation	*J. Isom, M. Shashanka, A. Tewari, A. Lazarevic*	*United Technologies Research Center*		
Integrated Software Platform for Fleet Data Analysis, Enhanced Diagnostics, and Safe Transition to Prognostics for Helicopter Component CBM	*R. Patrick, M.J. Smith, C.S. Byington, G. Vachtsevanos, K. Tom, C. Ly*	*Impact Technologies, LLC/ GeorgiaTech/ U.S. Army Research Laboratory*		
Detection of Precursors to Component Failure in a Spur Gear Drive-Train by Means of a Torque Transducer	*J. Yutzy, C. Bruns, N. Yoder, D. Adams*	*Purdue University/ Rolls-Royce*		
Paper Session 5B: Structural Health Management	**Steve Engel (Chair)**	*Northrop Grumman*	**Galleria North**	**3:30-5:00pm**
Integration of Remote Sensing and Risk Analysis for Airframe Structural Integrity Assessment	*D. Cope, J. Cronenberger, K. Kozak, K. Schrader*	*Southwest Research Institute*		
Theoretical Background and Prognostic Modeling for Benchmarking SHM Sensors for Composite Structures	*V. Smelyanski, V. Hafiychuk, D. Luchinsky, C. Banks, J. Miller*	*NASA Ames /NASA Marshall Space Flight Center*		
A Probabilistic Detectability-Based Structural Sensor Network Design Methodology for Prognostics and Health Management	*P. Wang, B. Youn, C. Hu*	*Wichita State University/ University of Maryland*		
Paper Session 5C: Electronic Prognostics II	**Sonia Vohnout (Chair)**	*Ridgetop Group*	**Parlor**	**3:30-5:00pm**
Towards Prognostics of Power MOSFETs: Accelerated Aging and Precursors of Failure	*J. Celaya, A. Saxena, P. Wysocki, S. Saha, K. Goebel*	*SGT Inc./ ASRC Aerospace/ MCT Inc./ NASA Ames*		
Modeling SiO2 Ion Impurities Aging in Insulated Gate Power Devices Under Temperature and Voltage Stress	*A. Ginart, J. Celaya, I. Ali, P. Kalgren, S. Poll, M. Roemer*	*Impact Technologies/ SGT /NASA Ames*		
Effects of Personnel Availability and Competency on Fleet Readiness	*L. Colosi, L. Rothrock, R. Barton, J. Banks*	*Pennsylvania State University*		
Annual Conference Banquet (Sponsored by Northrop Grumman) *(Within Walking Distance –Directions at Registration Desk)* *The Museum will open at 5 pm for a private viewing one hour prior to the dinner.*			**Portland Art Museum**	**5:00-9:00pm**

Thursday, October 14, 2010			Location	Times
Registration			**Plaza Foyer**	**7:00am–5:00pm**
Continental Breakfast (Xerox)			Grand Ballroom Foyer	7:00-8:00am
Exhibits			**Pavilion**	**8:00-11:00am**
Hardware Demos			**Galleria South**	**8:00-12noon**
Paper Session 6A: Materials PHM II	**Carl Byington (Chair)**	*Impact Technologies*	**Grand Ballroom II**	**8:00-9:50am**
Identification of Equivalent Damage Growth Parameters for General Crack Geometry	*A. Coppe, M.J. Pais, N. Kim, R. T. Haftka*	*University of Florida*		
Confidence Assessment in Fatigue Damage Prognosis	*S. Sankararaman, Y. Ling, S.Mahadevan*	*Vanderbilt University*		
Stochastic Characterization and Update of Fatigue Loading for Mechanical Damage Prognosis	*Y. Ling, C. Shantz, S. Sankararaman S. Mahadevan*	*Vanderbilt University*		
Paper Session 6B: Analytical PHM Methods II	**Bill Nickerson (Chair)**	*Impact-RLW*	**Galleria North**	**8:00-9:50am**
Improving Computational Efficiency of Prediction in Model-based Prognostics Using the Unscented Transform	*M. Daigle, K. Goebel*	*University of California, Santa Cruz/NASA Ames*		
Efficient Tracking of Behavior in Complex Hybrid Systems via Hybrid Bond Graphs	*B. Podgursky, G. Biswas, X. Koutsoukos*	*Vanderbilt University*		
Ensemble of Data-Driven Prognostic Algorithms with Weight Optimization and K-Fold Cross Validation	*C. Hu, B. D. Youn, P. Wang*	*University of Maryland/Wichita State University*		
Paper Session 6C: Machine Tool PHM II	**Jeff Banks (Chair)**	*Penn State ARL*	**Parlor**	**8:00-9:50am**
Fuzzy Clustering of Wavelet Features for Tool Condition Monitoring in High Speed Milling Process	*X. Li, B. Siong Lim, A.J. Torabi, M. Joo Er, Z. Lianyin, et. al.*	*Nanyang Technological University/SIMTech (Singapore)*		
Tool Wear Estimation Using Support Vector Machines in Ball-nose End Milling	*S. Huang, X.Li, O. Peen Gan*	*Singapore Institute of Manufacturing Technology*		
Characterizing Streaks in Printed Images: A Matching Pursuit Method using Wavelet Decomposition	*J. Liu, W. Wu, B. Price, E. Hamby, R. Minhas*	*Palo Alto Research Center (PARC)/ Xerox Research Center*		
Coffee Break (Sponsored by BAE Systems)			Pavilion	9:50-10:10am
Paper Session 7A: Prognostic Methods II	**Tolga Kurtoglu (Chair)**	*PARC*	**Grand Ballroom II**	**10:10-12noon**
Coupling a Dynamic Linear Model with Random Forest Regression to Predict Engine Wear	*J. Schimert, A. Wineland*	*Boeing*		
Forecasting Spacecraft Telemetry Using Modified Physical Predictions	*R. Mackey, I. Kulikov*	*California Institute of Technology*		
Airborne Electro-Mechanical Actuator Test Stand for Development of Prognostic Health Management Systems	*E. Balaban, A.Saxena, S. Narasimhan, I. Roychoudhury*	*NASA Ames / SGT Inc./ Oregon State University*		

Thursday, October 14, 2010			Location	Times
Paper Session 7B: Anomaly Detection II	**Jose Celaya (Chair)**	*NASA*	**Galleria North**	**10:10-12noon**
A Statistical Wavelet-Based Process for Systems Catastrophic Failure Precursor Detection	*O. Diallo, D. Mavris*	*GeorgiaTech*		
Advanced Vibration Sensing with Radar - ADVISER	*A. Peczalski, K. Kim, D. Mylaraswamy*	*Honeywell*		
The Use of Prognostic Health Management for Autonomous Unmanned Air Systems	*W. Glover, A. Lucas, J. Stecki*	*Agent Oriented Software Ltd. (UK) / PHM Technology (Australia)*		
Paper Session 7C: Machine Tool PHM III	**Bhaskar Saha (Chair)**	*NASA*	**Parlor**	**10:10-12noon**
Imaging Machine PHM	*Y. Xue, N.Eklund, F. Xue*	*General Electric Global Research Center*		
Intelligent Monitoring of Surface Integrity and Cutter Degradation in High-speed Milling Processes	*L. Zhai, M. Er, X. Li, O. Gan, S. Phua, S. Huang, J. Zhou, et. al.*	*Nanyang Technological University/SIMTech (Singapore)*		
Extracting Decision Trees from Diagnostic Bayesian Networks to Guide Test Selection	*S. Wahl, J.W. Sheppard*	*Montana State University*		
Exhibitor Teardown			Pavilion	11:00-3:00pm
Lunch Break (Attendees on Own)				12noon-1:00pm
Hardware Demo Teardown			Galleria South	12noon-3:00pm
Combined Session: Fielded Systems I	**Eric Hamby (Chair)**	*Xerox*	**Grand Ballroom II**	**1:00-2:50pm**
Coffee Break (Sponsored by BAE Systems)			Grand Ballroom Foyer	**2:50-3:10pm**
Combined Session: Fielded Systems II	**Andy Hess (Chair)**	*Hess PHM Group*	**Grand Ballroom II**	**3:10-4:30pm**
Final Remarks	**Mike Roemer (General Chair)**	*Impact Technologies*	**Grand Ballroom II**	**4:30-5:00pm**
Event Ends				**5:00pm**

Poster Presentations

Poster Title	Authors	Affiliations
Complex System Fault Detection Using Factor Analysis	*Y. Zhang*	*GM R&D Center*
Technical Condition Assessment and Remaining Useful Life Estimation of Choke Valves subject to Erosion	*B. H. Nystad, G. Gola, J.E. Hulsund, D. Roverso*	*Institute for Energy Technology (Norway)*
Bayesian Reliability Prognosis for Systems with Heterogeneous Information	*G. Bartram, S. Mahadevan*	*Vanderbilt University*
Uncertainty Identification of Damage Growth Parameters using Health Monitoring Data and Nonlinear Regression	*N. Kim, A. Coppe, R.T. Haftka*	*University of Florida*
Aging Methodologies and Prognostic Health Management for Electrolytic Capacitors	*K. Goebel, G. Biswas, X. Koutsoukos, J. Celaya, C. Kulkarni*	*Vanderbilt University/NASA Ames*
A Novel Automated Feature Extraction Method for Fault Diagnosis	*Z. Voulgaris, C. Sconyers*	*Georgia Institute of Technology*
Robustness of a structural health monitoring system under drop-weight impact loading in composites	*P. Ostiguy, K. Ryan Mulligan, P. Masson, S. Elkoun*	*GAUS, Université de Sherbrooke (Canada)*
A Collaborative Web-Based Approach to Planning Research, Integration, and Testing using a Wiki	*M. Delaney, E. Koshimoto, D. Noble, C. Duggan*	*NASA*
Modeling SiO2 Ion Impurities Aging in Insulated Gate Power Devices Under Temperature and Voltage Stress	*A. Ginart, J. Celaya, I. Ali, P. Kalgren, S. Poll, J. Celaya, M. Roemer*	*Impact Technologies, LLC/NASA Ames*
Next Generation Health Management Decision Support across the Operational and Support Enterprise	*T. Dabney, T. Postma, R. Vodicka*	*USAF, JSF Program Office*
An Autonomous Wireless Sensing Module for Long-Term Structural Health Monitoring Applications	*N. Belov, G. Tchelepi*	*Green SHM Systems*
Methods for Diagnostics of Bearings in Non-stationary Environment	*R. Klein, E. Rudyk, E. Masad*	*R. K. Diagnostics (Israel)*
Detecting Corrosion of Prestressed Strands Using Acoustic Emission Technique	*M. El-Batanouny, J. Mangual, P. Ziehl*	*University of South Carolina*
Benchmarking the Vehicle Integrated Prognostic Reasoner	*X. Koutsoukos, G. Biswas, D. Mylaraswamy*	*Vanderbilt University/ Honeywell/Lockheed*
PHM Techniques for Condition-Based Maintenance Based on Hybrid System Model Representation	*C. García, T. Escobet, J.Quevedo*	*Universitat Politècnica de Catalunya (Spain)*
Bayesian Approach for Parameter Estimation in the Structural Analysis and Prognosis	*J. Choi, D. An, J. Gang, J. Joo, N. Kim*	*Korea Aerospace University/Chungbuk National University (Korea)/University of Florida*
Multiple Faults Isolation for Hybrid Systems with Unknown Fault Pattern	*M. Yu, D. Wang, M. Luo*	*Nanyang Technological University/ Singapore Institute of Manufacturing Technology*

Doctoral Symposium Participants

Topic	Speaker	Affiliation
A Health Prognostic System for Wet Friction Clutches	*Agusmian Partogi*	*Katholieke Universiteit Leuven*
Load Allocation For Risk Management In Overactuated Systems Experiencing Incipient Failure Conditions	*Brian M Bole*	*Georgia Tech*
Experiment and Prognostic Studies of Ageing in Electrolytic Capacitors	*Chetan Kulkarni*	*Vanderbilt University*
PHM Strategies Applying Hybrid System Representation for Advanced Maintenance	*Claudia Maria García*	*Universitat Polytechnica de Cataluna, (Spain)*
An Options Framework for Optimal Maintenance Decisions when Using PHM	*Gilbert Haddad*	*University of Maryland (UMD)*
Development of Integrated Prognostics: An Application to Hybrid Ceramic Bearing Life Prediction	*Jinghua Ma*	*The University of Illinois at Chicago (UIC)*
Structural Fatigue Prognosis Using Limited Sensor Data	*Jingjing He*	*Clarkson University*
Full Ceramic Bearing Health Monitoring, Diagnostics and Prognostics with Acoustic Emission and Vibration Sensors	*Junda Zhu*	*The University of Illinois at Chicago (UIC)*
On-board / Off-board Optimal Partitioning Problem for Integrated Vehicle Management (IVHM) System	*Piotr Sydor*	*Cranfield University, IVHM Centre*
Probabilistic Methods for Real-Time Fatigue Damage Prognosis	*Yibing Xiang*	*Clarkson University*

Exhibits Floor Plan

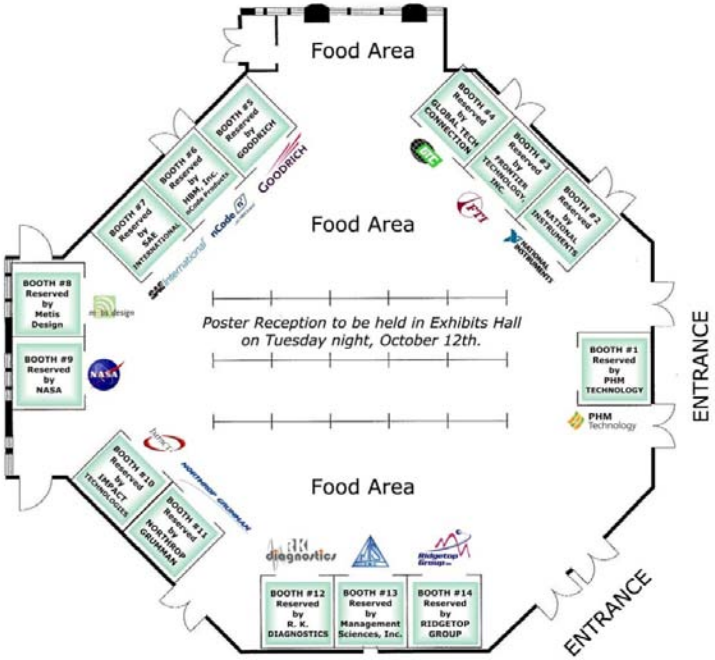


Exhibit Hours

Monday, October 11, 2010	Setup Welcome/Exhibitors Reception	12noon – 5:00pm 5:30pm – 7:30pm
Tuesday, October 12, 2010	Exhibit Hours Poster Reception/Exhibits Hall	8:00am – 4:00pm 5:30pm – 8:00pm
Wednesday, October 13, 2010	Exhibit Hours	12noon – 4:30pm
Thursday, October 14, 2010	Exhibit Hours Teardown	8:00am – 11:00am 11:00am – 3:00pm

Social Program

Exhibitors Reception - Microbrew Monday
Monday, October 11, 2010, Exhibit Hall
5:30-7:30pm
Join us for the Exhibitors Reception and taste some of the local Microbrews that Portland has to offer, sponsored by Goodrich.

Poster Reception - Tasteful Tuesday
Tuesday, October 12, 2010, Exhibit Hall
5:00-8:00pm
While viewing the selected posters, enjoy a sampling of the Oregon Valley's most tasteful wines, Sponsored by SAE International, Inc.

Annual Conference Banquet at the Portland Art Museum
Wednesday, October 13, 2010
5:00-9:00pm
The annual conference banquet will take place at the Portland Art Museum located at 1219 SW Park Avenue in Portland. The museum is within walking distance from the Hilton and directions will be provided at the registration desk. The Portland Art Museum will be open to all banquet attendees one hour prior to the event for a special viewing.

Travel and Sightseeing

Places to Visit

- Pearl District
- Oregon Museum of Science and Industry
- Powells City of Books
- Portland Japanese Garden
- Pittock Mansion

Tours

Willamette Valley Wine Tasting Tour
Sunday, October 10, 2010, 12noon-5:00pm
Willamette Valley is the Heart of Oregon Wine Country and is a short drive from Portland. The tour will be hosted by an experienced wine enthusiast who has been conducting small group tours in the Willamette Valley area for a long time. If you are not a wine expert or intimidated by the terminology or rituals of wine tasting, this is the tour for you! The tour is designed to help you "expand your ability to smell and taste wine and to have a most enjoyable time learning to do so."

The tour cost is $85 per person. The cost includes private transportation to/from the Hilton, guide, tasting fees, and appetizers. The tour is limited to a small number of participants, so please reserve your spot early!

After the Conference

Mount St. Helens Tour
Friday, October 15, 2010, 12noon-7:00pm
Join us as knowledgeable guides from EcoTours tell us about the "blast zone," mudflows, pyroclastic flows, biological regeneration and the largest avalanche recorded by man. The immense effects from the eruption of Mount Saint Helens on the surrounding region must be seen to be appreciated. Incredible photo stops including the Johnston Ridge Observatory, which includes exhibits, a 20-minute film, and hiking trails. We will depart from the conference hotel at noon and return to the hotel around 7 pm. A boxed lunch will be provided.

This tour is included in registration fees for DX 2010 attendees - they DO NOT need to sign up for the tour separately. PHM conference participants may attend the tour at a cost of $80 per person.

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Carl Byington (Impact Technologies)
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Jeff Bird (NRC)

Fielded Systems Chairs
Andy Hess (Hess PHM Group)
Eric Hamby (Xerox)

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Chris Hockley (Defence Academy, UK)
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The Annual Conference of the Prognostics and Health Management Society

September 25-29, 2011

Hilton Bonaventure
Montreal, Quebec, Canada

Prognostics and Health Management (PHM) is a system engineering discipline focusing on detection, prediction, and management of the health and status of complex engineered systems. PHM 2011 is the 3rd annual international conference to bring together experts from industry, academia, and government in diverse PHM application areas such as aerospace, transportation, automotive, energy, and industrial automation. This year's conference will highlight Canadian and international activities and savour the Montreal technology and cultural fare. Visit www.phmsociety.org for more information.

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