For years, the field of PHM was represented under a variety of banners, including aerospace, reliability, failure analysis and prevention, mechanical engineering, and others. PHM is broader than any single field of study. The PHM Society was established to unite the diverse 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 synergizes these fields.

PHM Society membership is free and entitles you to full access to papers, tutorials and proceedings—join or update your profile today!

Get details of the Conference using the free Whova mobile app on your phone or tablet. See page 11 for details.
Welcome to beautiful St. Petersburg, for the 2017 Annual Conference of the Prognostics and Health Management Society. At this, the 9th domestic conference of the PHM Society, we are delighted to celebrate the good fortune and preparation that allowed the Tampa-St. Petersburg-Clearwater area to so successfully weather hurricane Irma and to offer our best wishes to those parts of Florida that are still recovering from the storm. We have an exciting program this year that builds on the success of our previous conferences. The conferences of the past two years featured the sunshine of San Diego and the open skies of Denver. This year, now that the hurricane has passed, we double down on the sunshine and the view! St. Petersburg, known as the “sunshine city”, is the holder of a Guinness world record for an epic stretch of sunshine that lasted 768 days. So in the tradition of the best data-driven prognostication, our prediction is for delightful weather and an intellectually rewarding conference!

In addition to its stunning beaches and weather, St. Petersburg is known for its world-renowned museums, top-rated restaurants, and for beautiful Fort De Soto Park, a sprawling littoral park that includes five interconnected keys that are home to beach plants, mangroves, wetlands, palm hammocks, hardwoods and scores of native plants. As its name suggests, the park also offers the opportunity to tour the historically significant Fort De Soto. The Salvador Dali Museum is the largest collection of Dali’s work outside of Spain and is home to 7 of his 18 masterwork paintings as part of a collection that includes 96 oil paintings, over 100 watercolors and drawings, 1,300 graphics, photographs, sculptures and objects d’art. The Chihuly Collection of the Morean Arts Center is a collection of world-renowned artist Dale Chihuly’s unique glass artwork, displayed in a 10,000-permanent setting. The mission of the St. Petersburg Museum of History includes collections on the history and heritage of Florida with emphasis on St. Petersburg and the Pinellas Peninsula. The PHM 2017 banquet will be held at the nearby St. Petersburg Museum of the Fine Arts. The museum has a collection of more than 20,000 objects includes major works by Monet, Morisot, Barye, Rodin, O’Keeffe, Pearlstein, and Wyeth, along with ancient Greek and Roman, Egyptian, Asian, African, pre-Columbian, Native American art. Be sure to ask about the ancient artifacts buried in the museum’s lawn!

The Hilton Bayfront is located in downtown St. Petersburg, the heart of the city and home to great shopping, restaurants, and attractions. Locale Market is a unique 20,000 sq-foot marketplace offering the region’s freshest and finest artisanal foods. The real fun in St. Pete, starts when the sun goes down. Central Avenue is home to numerous clubs and bars including Enigma, a dance club, The Mandarin Hide and Emerald Bar. On Beach Drive, The Canopy Rooftop Lounge is a hotspot for cocktails overlooking the marina, and for live music in a small and intimate setting. Jannus Live is a top choice with a constant lineup of touring bands. The St. Petersburg Trolley’s Downtown Looper route is one of the easiest ways, and certainly the most nostalgic, to get around the downtown area. Look for the bright red and yellow trolleys, board for just 50 cents and connect to all the city’s major museums and attractions. If you prefer pedaling, sign up for Coast Bike Share and take advantage of their pay-as-you-go options. You may also want to try a guided tour of the city and Tampa Bay. There are Segway tours, boat tours (including dolphin watching), ghost tours, photo tours, and historic tours.

The Tampa Bay area offers wonderful outdoor activities, especially of course in the water sports. Rent a kayak or canoe at Weedon Island, swim the secluded waters of award-winning Caladesi Island, go fishing in the crystal waters of the Gulf of Mexico, or even go horseback riding on the beach. There are plenty of opportunities to keep up with your cardio exercise, too! Bike the 40-mile Pinellas Trail, take a hike at Brooker Creek Preserve or Boyd Hill Nature Park, or jog across the Clearwater Memorial Causeway with scenic views of the intercoastal waterway. Or simply get back to nature by camping on the beaches of State Parks like Anclote Key and Fort De Soto, or by bird-watching on the Great Florida Birding and Wildlife Trail.

The program for the PHM 2017 Conference is rich with technical content and the events offer many opportunities to make and renew professional connections in the field. Please enjoy this program, but also be sure to step outside into the sunshine to explore the Tampa-St. Petersburg-Clearwater area. This area is one of the jewels of Florida and there is much to experience. We hope you have a rewarding week here!

David Larsen and Peter Beling
2017 Conference Co-Chairs

The Conference

The Prognostics and Health Management Society (PHM Society) welcomes you to its annual international conference. As the Society’s annual flagship event, the 2017 PHM Conference brings together the global community of PHM experts from industry, academia, and government in diverse application areas such as smart manufacturing, wind energy, oil and gas, aerospace, transportation, automotive, and industrial automation. The conference features keynote and luminary presentations, invited panel sessions, technology demonstrations, a data challenge, a doctoral symposium, tutorials free to all registrants, a dedicated poster session during planned social hours, a Job Fair, a one-day deep learning workshop and two, two-day intensive short courses (PHM Fundamentals and PHM Data Analytics) in conjunction with the conference. Several social events will provide opportunities for participants to connect with colleagues.

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 includes high-quality tutorials, and original contributions submitted as full-length papers and posters. All submissions are 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 and applications community.

Welcome to St. Petersburg!

The Prognostics and Health Management Society (PHM Society) welcomes you to its annual international conference. As the Society’s annual flagship event, the 2017 PHM Conference brings together the global community of PHM experts from industry, academia, and government in diverse application areas such as smart manufacturing, wind energy, oil and gas, aerospace, transportation, automotive, and industrial automation. The conference features keynote and luminary presentations, invited panel sessions, technology demonstrations, a data challenge, a doctoral symposium, tutorials free to all registrants, a dedicated poster session during planned social hours, a Job Fair, a one-day deep learning workshop and two, two-day intensive short courses (PHM Fundamentals and PHM Data Analytics) in conjunction with the conference. Several social events will provide opportunities for participants to connect with colleagues.
## Optional PHM Fundamentals Short Course Details and Agenda

### September 30 – October 1, Room: Harbor View

Separate Registration Required

Course Leaders: Dr. George Vachtsevanos (Georgia Tech) and Dr. Karl Reichard (Pennsylvania State University)

Course Administrator: Jeff Bird (TECnos)

The PHM Society offers this updated two-day intensive short course titled **PHM Fundamentals and Case Studies—From Monitoring/Sensing to Fault Diagnosis/Failure Prognosis and Case Studies**, on PHM tools, methods, applications and case studies on Saturday, September 30 and Sunday, October 1 in St Petersburg, Florida USA right before the PHM17 conference. This follows from the first offering at the PHM14 conference in Fort Worth, TX with 48 attendees and ratings of 4/5. It was also run in 2015 in San Diego, 2016 in both Bilbao, Spain and Denver US. There is a Deep Learning Workshop you can attend on Monday October 2 for a minimal fee,

As in the previous offerings, the course will be taught by recognized experts in the PHM field and will cover the current state of the art in PHM technologies, sensors and sensing strategies, data mining tools, CBM+ technologies, novel diagnostic and prognostic algorithms as well as a diverse array of application examples/case studies. It is addressed to engineers, scientists, operations managers, educators, small business principals and system designers interested to learn how these emerging technologies can impact their work environment.

Through a lecture (with Q&A), networking and workshop format with specialist experts, participants will:

- Describe a baseline for defining the extent and capabilities of PHM, specifically needs and organization
- Identify specific details of PHM Applications (metrics, sensors, cost benefits, reliability) and PHM Methods (diagnostics, prognostics, data driven methods and uncertainty)
- Identify issues and needs and a way forward including Continuing Professional Development
- Examine case studies of PHM applications across diverse domains to identify solutions and impacts
- Plan a PHM application in two mini workshop settings with expert group leaders

Note: A PHM Society Certificate will be provided for 1.4 Continuing Professional Development Units to each participant completing the course.

### Saturday, September 30, 2017

- **8:00 – 10:30** Session 1: Welcome and Introductions, Introduction to PHM, Deriving Requirements for PHM, PHM Performance Metrics, Harbor View
- **10:30 – 10:45** Break
- **10:45 – 12:00** Session 2: Diagnostics Methods, Diagnostics Case Studies, Harbor View
- **12:00 – 1:00** Lunch (provided), Grand Bay South Ballroom
- **1:00 – 3:15** Session 3: Prognostics, Data Analytics Methods, Prognostics Case Studies, Harbor View
- **3:15 – 3:30** Break
- **3:30 – 5:15** Session 4: Sensors and Data Processing Analysis Mini–Workshop, Summary of Workshop Results, Harbor View
- **5:15 – 7:30** Free Time
- **7:30 – ?** Non-hosted dinner with all participants

### Sunday, October 1, 2017

- **8:30 – 10:30** Session 5: CBM+ and IVHM Technologies, PHM Management Cost Benefit Analysis, Plenary—Issues and Needs, Harbor View
- **10:30 – 10:45** Break
- **10:45 – 12:30** Session 6: Reliability and Life Cycle Management Fielded Systems Case Studies – 1, Harbor View
- **12:30 – 1:30** Lunch (provided), Grand Bay South Ballroom
- **1:30 – 3:20** Session 7: Fielded Systems Case Studies – 2, Case Study Mini–Workshop Introduction, Case Study Mini–Workshop, Harbor View
- **3:20 – 3:40** Break
- **3:40 – 4:15** Session 8: Way Forward, Wrap up with Evaluation Forms, Harbor View
Optional PHM Data Analytics Short Course Details and Agenda

September 30 – October 1, Room: Harbor View
Separate Registration Required
Course Leader: Dr. Neil Eklund (Analatom)
Course Administrator: Jeff Bird (TECNos)

This course is intended for engineers, scientists, and managers who are interested in data driven methods for asset health management. You will learn how to identify potential data driven projects, visualize data, screen data, construct and select appropriate features, build models of assets from data, evaluate and select models, and deploy asset monitoring systems.

By the end of the course, you will have learned the essential skills of processing, manipulating and analyzing data of various types, creating advanced visualizations, detecting anomalous behavior, diagnosing faults, and estimating remaining useful life.

The course is about two-thirds lecture, and an optional one-third hands-on lab. Students who elect to take the lab will be expected to bring a laptop, and have some free software pre-installed.

A PHM Society Certificate will be provided for nominally 1.4 Continuing Professional Development Units to each participant completing the lecture and lab portion of the course, or 1.0 Continuing Professional Development Units to each participant completing only the lecture.

The course is designed for two primary types of students:
Managers who oversee asset health management projects, and want to know more about the technical details behind the process.
Practitioners who want to know the theory and get hands-on experience for data driven PHM, including:
  • Students
  • New engineers and scientists
  • Experienced engineers and scientists looking to update their skills and understanding data driven methods
  • Project managers who incorporate data driven PHM in their projects
  • Individuals with a general understanding of analytics who want to see how it is applied to PHM

Note that this course is an advanced course with only a cursory background in PHM presented - students are expected to know the basics of PHM already. New practitioners are encouraged to take the PHM fundamentals course or contact the course leader to examine their background and skills.

### Saturday, September 30, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1: Welcome and Introductions</th>
<th>Williams &amp; Demens</th>
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</thead>
<tbody>
<tr>
<td>8:00 – 10:30</td>
<td>Overview of Data-driven PHM</td>
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<tr>
<td>10:30 – 10:45</td>
<td>Review of Basic Statistics</td>
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<tr>
<td>10:45 – 12:00</td>
<td>Exploratory Data Analysis</td>
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<tr>
<td>12:00 – 1:00</td>
<td>Lunch (provided)</td>
<td>Grand Bay South Ballroom</td>
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<tr>
<td>1:00 – 3:15</td>
<td>Session 3: Regression</td>
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<td>3:15 – 3:30</td>
<td>Break</td>
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<td>3:30 – 5:15</td>
<td>Session 4: Hands-on Lab</td>
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<td>5:15 – 7:30</td>
<td>Free Time</td>
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<tr>
<td>7:30 – ?</td>
<td>Non-hosted dinner with all participants</td>
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</table>

### Sunday, October 1, 2017

| Time       | Session 5: Feature Selection         |
|------------|--------------------------------------|------------------|
| 8:30 – 10:30 | Characterizing Performance           |
| 10:30 – 10:45 | Break                                |
| 10:45 – 12:30 | Session 6: Model Selection           |
| 12:30 – 1:30 | Lunch (provided)                     | Grand Bay South Ballroom |
| 1:30 – 3:20 | Session 7: Anomaly Detection         |
| 3:20 – 3:40 | Break                                |
| 3:40 – 5:15 | Session 8: Hands-on Lab              |
|            | Wrap up with Evaluation Forms        |

Annual Conference of the Prognostics and Health Management Society 2017
4 Annual Conference of the Prognostics and Health Management Society 2017

Optional Deep Learning Workshop Details and Agenda

Monday, October 2, 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Deep Learning Workshop</th>
<th>Doctoral Symposium</th>
</tr>
</thead>
<tbody>
<tr>
<td>7AM – 5PM</td>
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<td>Registration</td>
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<td>8:00 – 9:00</td>
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<td>Free Time</td>
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<td>9:00 – 12:00</td>
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<td>Deep Learning Workshop</td>
<td>Doctoral Symposium</td>
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<td>Separate Registration Required</td>
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<td>12:00 – 1:00</td>
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<td>Lunch</td>
<td>Doctoral Symposium</td>
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<td>1:00 – 4:30</td>
<td></td>
<td>Deep Learning Workshop</td>
<td>Doctoral Symposium</td>
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<td></td>
<td>Separate Registration Required</td>
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<tr>
<td>4:30 – 5:30</td>
<td></td>
<td>Free Time</td>
<td></td>
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<tr>
<td>5:30 – 7:30</td>
<td></td>
<td>Opening Welcome Reception with Cocktails</td>
<td>Location: Poolside</td>
</tr>
</tbody>
</table>

Monday, October 2, 2017, Room: St. Petersburg 1

Separate Registration Required

Workshop Leaders: Dr. Neil Eklund (Analatom), Dr. Weizhong Yan (GE Research), and Dr. Jose Celaya (Schlumberger)

The Prognostics and Health Management Society Annual Conference is the premier meeting of experts on Prognostics, Diagnostics, and System Health Management. Building on the 2015 Conference Deep Learning for Feature Engineering tutorial, and the large number of papers on deep learning presented at the 2016 Conference, we are holding a dedicated one-day Deep Learning for Industrial Analytics Workshop at the 2017 Conference. This first-of-a-kind workshop brings together experts from the PHM community and the deep learning community and provide an ideal forum for technical interchange and exploring the transfer of deep learning techniques from other applications to PHM.

The past ten years have witnessed a revolution in machine learning, statistics, and hardware. Neural networks have risen from relative obscurity as a collection of innovative new techniques known as Deep Learning, and are achieving human-level performance in image recognition and game playing. Around the same time, a niche discipline of Industrial Analytics has emerged, characterized by predictive analytics and optimization for fleets of similar assets – e.g., aircraft engines, subsea oil pumps, computed tomography scanners. Papers describing both novel applications of the combination of these techniques and related theory are encouraged.

The workshop will consist of invited talks, panels with deep learning researchers, and technical papers.

Topics of interest include:
- Detection, Diagnostics & Prognostics Methods
- Deep Learning for time series data
- Adaptive Control & Fault Accommodation
- Autonomous Systems/Robotic Technologies
- Decision Support Systems

With applications in:
- Automotive
- Medical Equipment
- Smart Manufacturing
- Aviation
- Mining
- Wind Energy
- Locomotive
- Oil & Gas
- etc.
- Marine
- Smart Grid
- etc.

Organizing Committee:
- Neil Eklund (Analatom), Workshop Chair
- José Celaya (Schlumberger)
- Weizhong Yan (GE Research)

Monday, October 2, 2017

9:00 – 10:30 Session 1: Welcome and Introduction Keynote I

10:30 – 11:00 Break

11:00 – 12:00 Session 2: Keynote II

12:00 – 1:00 Lunch (provided)

1:00 – 2:30 Session 3: Panel Session I: Applications

2:30 – 3:00 Break

3:00 – 4:30 Session 4: Panel Session II: Future of Deep Learning and PHM

Want to be a part of next year’s PHME2018 Conference (in the Netherlands) or PHM2018 Conference (in Philadelphia)? See page 18 for details!
Doctoral Symposium Agenda
(See Page 12 for Details)

Monday, October 2, 2017

8:00 – 9:15 Breakfast (provided) Bayboro
9:15 – 9:30 Doctoral Symposium Welcome
9:30 – 9:50 Presentation #1: Bayboro
A New Approach to High Impedance Fault Detection and Location for Distribution Systems – Roghieh Abdollahi (Clemson University)
9:50 – 10:20 Panelist Feedback (20m) / Audience Q&A (10m)
10:20 – 10:40 Presentation #2: Bayboro
Development of Deep Learning Based Prognostics for Rotating Components – Jason Deutsch (University of Illinois, Chicago)
10:40 – 11:10 Panelist Feedback (20m) / Audience Q&A (10m)
11:10 – 11:30 Presentation #3: Bayboro
Fleet Prognostics and Health Management – A General Process Model for Data-Driven Fleet Analytics – Carolin Wagner (University of Münster)
11:30 – 12:00 Panelist Feedback (20m) / Audience Q&A (10m)
12:00 – 1:00 Lunch (provided) Bayboro
1:00 – 1:20 Presentation #4: Bayboro
Probabilistic Life Prediction and Prognostics-Based Maintenance Optimization for Gas Pipelines – Yuhao Wang (Arizona State University)
1:20 – 1:50 Panelist Feedback (20m) / Audience Q&A (10m)
1:50 – 2:10 Presentation #5: Bayboro
Vibration-Based Fault Detection and Quantification for Primary Flight Control Electro-Mechanical Actuators – Mohamed Ismail (Institute of Flight Systems, German Aerospace Center (DLR))
2:10 – 2:40 Panelist Feedback (20m) / Audience Q&A (10m)
2:40 – 3:00 Break
3:00 – 3:20 Presentation #6: Bayboro
Enhanced System Health Assessment Using Adaptive Self-Learning Techniques – Yuan Di (University of Cincinnati)
3:20 – 3:50 Panelist Feedback (20m) / Audience Q&A (10m)
3:50 – 4:10 Presentation #7: Bayboro
Development and Application of Advanced Data-Driven Methods for Prognostics and Health Management of Industrial Components under Scarcie Degradation Information – Francesco Cannarile (Politecnico di Milano)
4:10 – 4:40 Panelist Feedback (20m) / Audience Q&A (10m)
4:40 – 5:00 Panelists Final Thoughts
5:00 – 5:15 Feedback from Students & Audience

Round Table Panel on Next Generation PHM and Intelligent System Technologies
(Co-Located with PHM2017)

Sunday, October 1, 8:30 – 5:00, Room: Bayboro
Limited Attendance for Invited Speakers and Participant. Other interested attendees please contact event organizing committee.

Organizing Committee:
Jay Lee (University of Cincinnati), Round Table Chair
Andrew Hess (The Hess PHM Group)
Jerry Shan (Huawei)
Yuhong Zhang (Huawei)

Scope: Discuss and identify the Next Generation PHM and Intelligent System Technologies (including machine learning, industrial big Data, digital twin, and etc.) as well as their Impacts to Future Smart Product, Manufacturing, and Service Systems.

Roundtable Format: The Panel consists of 10-12 Subject Matter Experts from the industry and the academia. Each panelist will give a 25-minute presentation on the Next Generation Intelligent System Technologies: machine learning, industrial big Data, and etc. based on his/her work and research experience. The participants and panelists will have open discussions throughout the day.

Speaker List:
Jay Lee (University of Cincinnati)
Andrew Hess (The Hess PHM Group)
Dragan Djurdjanovic (University of Texas at Austin)
Neil Eklund (Analatom)
Kai Goebel (NASA)
Karl Reichard (Pennsylvania State University)
Abhinav Saxena (GE Global Research)
Terry Hickey (IBM Global Services)
Weizhong Yan (GE Global Research)
Hendrik F. Hamann (IBM Research)
Jerry Shan (Huawei)
David Siegel (Predictronics)

(or http://bit.ly/2flocHr5)

Hurricane Relief Efforts

The PHM Society stands with the victims of the recent spate of hurricanes and encourages all of its members to consider donating to the relief efforts. Hurricane Irma narrowly missed a direct hit on the PHM Conference venue itself in St. Petersburg but did inflict great damage. The Charity Navigator website provides one way to ensure your dollars are having the greatest possible impact for those in need. Please see https://www.charitynavigator.org/index.cfm?bay=content.view&cpid=5243 (or http://bit.ly/2wX7Thg) and THANK YOU!
<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Technical Paper Sessions</th>
<th>Technical Paper &amp; Tutorial Sessions</th>
<th>Career Fair</th>
</tr>
</thead>
<tbody>
<tr>
<td>7AM – 5PM</td>
<td></td>
<td>Registration</td>
<td></td>
<td></td>
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<tr>
<td>7:30 – 8:00</td>
<td></td>
<td>Continental Breakfast</td>
<td>Location: Grand Bay Ballroom &amp; Foyer</td>
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<tr>
<td>8:00 – 8:45</td>
<td></td>
<td>Opening Remarks</td>
<td>Location: Grand Bay Ballroom</td>
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<tr>
<td>8:45 – 10:15</td>
<td></td>
<td>Paper Session 1A: Batteries I</td>
<td>Paper Session 1B:</td>
<td></td>
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<tr>
<td>10:15 – 10:30</td>
<td></td>
<td>Break</td>
<td>Location: St. Petersburg Foyer</td>
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<tr>
<td>10:30 – 12:00</td>
<td></td>
<td>Paper Session 2A: Batteries II</td>
<td>Paper Session 2B:</td>
<td></td>
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<tr>
<td>12:00 – 1:15</td>
<td></td>
<td>Conference Lunch</td>
<td>Location: Grand Bay Ballroom</td>
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<tr>
<td>1:15 – 3:00</td>
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<td>Paper Session 3A: Wind Turbines</td>
<td>Tutorial Session 1:</td>
<td></td>
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<tr>
<td>3:00 – 3:30</td>
<td></td>
<td>Break</td>
<td>Location: St. Petersburg Foyer</td>
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<tr>
<td>3:30 – 5:00</td>
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<td>Paper Session 4A: Diagnostics</td>
<td>Tutorial Session 2:</td>
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<tr>
<td>5:00 – 6:00</td>
<td></td>
<td>Free Time</td>
<td>Location: Grand Bay Ballroom</td>
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<tr>
<td>6:00 – 7:30</td>
<td></td>
<td>Cocktail Reception with Posters</td>
<td>Location: Grand Bay Ballroom</td>
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</tbody>
</table>

**Paper Session 1A: Batteries I**
Tuesday, 8:45 – 10:15, Room: St. Petersburg 2

**Session Chair: Kai Goebel (NASA Ames Research Center)**

Energy Management of Electric Bicycles Given a Traveling Elevation Profile – Sebastián Serra¹, Vanessa Quintero², Pablo A. Espinoza³, Aramis Pérez⁴, Francisco Jaramillo⁵, Matías Benavides⁶, Marcos Orchard⁷ (¹University of Chile, Chile)

Use of Teaching-Learning Based Optimization for Filter Parameter Tuning in the Prognostics of a Quadrotor Battery – Leonardo Ramos Rodrigues¹, João Paulo Pordeus Gomes², Vandilberto Pereira Pinto³, Roberto Kawakami Harrop Galvão⁴ (¹Institute of Aeronautics and Space, Brazil; ²Federal University of Ceará, Brazil; ³Instituto Tecnológico de Aeronáutica, Brazil)

GPU Accelerated Prognostics – George E. Gorospe¹, Matthew J. Daigle², Shankar Sankararaman³, Chetan S. Kulkarni⁴, Eley Ng⁵ (¹SGT Inc., NASA Ames Research Center; ²NIO USA, Inc.; ³Universities Space Research Association)

Lithium-ion Battery Remaining Useful Life Prediction with Long Short-term Memory Recurrent Neural Network – Yuefeng Liu¹, Guangquan Zhao², Xiyuan Peng³, Cong Hu⁴ (¹Harbin Institute of Technology, China; ²Inner Mongolia University of Science & Technology, Inner Mongolia; ³Guilin University of Electronic Technology, China)

**Paper Session 1B: Industrial & Manufacturing Applications**
Tuesday, 8:45 – 10:15, Room: St. Petersburg 3

**Session Chair: Francesco Cannarile (Politecnico di Milano)**

Fleet Knowledge for Prognostics and Health Management – Identifying Fleet Dimensions and Characteristics for the Categorization of Fleets – Carolin Wagner¹, Bernd Hellingrath² (¹Westfälische Wilhelms-Universität Münster, Germany)

Dynamic Modeling of Maintenance Prices in the Aerospace Industry – George S. Ekladiou³, Xiaojun Zhao⁴, Hala Mostafa⁵, Ramona Georgescu⁶ (³²³⁴United Technologies Research Center)

Case Studies in using Consumer Analytics with PHM Strategy – Sameer Vittal¹, Mark Sporer² (¹GE Power; ²GE Renewables)

A New Application for Failure Prognostics – Reduction of Automotive Electronics Reliability Test Duration – André Kleyner¹, Arvind Vasan², Michael Pech⁴ (¹Delphi Electronics & Safety; ²Empower Micro Systems Inc.; ³CALCE Research Center, University of Maryland)

**Paper Session 2A: Batteries II**
Tuesday, 10:30 – 12:00, Room: St. Petersburg 2

**Session Chair: Chetan Kulkarni (SGT Inc., NASA Ames Research Center)**


A Simulation Engine for Predicting State-of-Charge and State-of-Health in Lithium-Ion Battery Packs of Electric Vehicles – Pablo A. Espinoza¹, Aramis Pérez², Marcos E. Orchard³, Hugo F. Navarrete⁴, Daniel A. Pola⁵ (¹²³University of Chile, Chile)

An Improved Model for Remaining Useful Life Prediction on Capacity Degradation and Regeneration of Lithium-ion Battery – Li-Ming Deng¹, Yu-Cheng Hsu², Han-Xiong Li³ (¹²³University of Hong Kong, China)

**Paper Session 2B: Deep Learning**
Tuesday, 10:30 – 12:00, Room: St. Petersburg 3

**Session Chair: Neil Eklund (ANALATOM)**
<table>
<thead>
<tr>
<th>Time</th>
<th>Registration</th>
<th>Continental Breakfast</th>
<th>Opening Remarks</th>
<th>Luminary Presentation: Elaine Spiller (Marquette University)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7AM – 5PM</td>
<td>Location: Grand Bay Ballroom &amp; Foyer</td>
<td>Location: Grand Bay Ballroom</td>
<td>8:00 – 8:45</td>
<td>“Uncertainty in hazard forecasting; Or where will you go when the volcano blows?”</td>
</tr>
<tr>
<td>10:30 – 12:00</td>
<td>Panel Session 2: Human Machine Interfaces for Smart PHM</td>
<td>Reserved for PHM Conference</td>
<td>10:30 – 12:00</td>
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<tr>
<td>12:00 – 1:15</td>
<td>Break</td>
<td>Location: St. Petersburg Foyer</td>
<td>10:15 – 10:30</td>
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<tr>
<td>1:15 – 3:00</td>
<td>Panel Session 3: Automotive PHM and Emerging Standards</td>
<td>Technology Demonstration: Automotive Application of PHM Concepts via Cadillac SRX Rig [General Motors]</td>
<td>1:15 – 3:00</td>
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<tr>
<td>5:00 – 6:00</td>
<td>Free Time</td>
<td>Location: Grand Bay Ballroom</td>
<td>5:00 – 6:00</td>
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<tr>
<td>6:00 – 7:30</td>
<td>Cocktail Reception with Posters</td>
<td>Location: Grand Bay Ballroom</td>
<td>6:00 – 7:30</td>
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**Technology Demonstrations**

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<thead>
<tr>
<th>Day</th>
<th>Location</th>
<th>Time</th>
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<tbody>
<tr>
<td>Tuesday, October 3, 2017</td>
<td>Williams &amp; Demens</td>
<td>1:15 – 3:00</td>
</tr>
<tr>
<td>General Motors</td>
<td>Automotive Application of PHM Concepts via Cadillac SRX Rig</td>
<td>1:15 – 3:00</td>
</tr>
<tr>
<td>MathWorks</td>
<td>Machine Health Monitoring via Internet of Things Platform</td>
<td>3:30 – 5:00</td>
</tr>
<tr>
<td>Wednesday, October 4, 2017</td>
<td>Williams &amp; Demens</td>
<td>1:15 – 3:00</td>
</tr>
<tr>
<td>General Motors</td>
<td>Automotive Application of PHM Concepts via Cadillac SRX Rig</td>
<td>1:15 – 3:00</td>
</tr>
<tr>
<td>Life Prediction Technologies</td>
<td>Model-based Predictive Maintenance Solutions for Specific Turbine Engines</td>
<td>3:30 – 5:00</td>
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</table>

**Panel Sessions**

<table>
<thead>
<tr>
<th>Panel Session 3A: Wind Turbines</th>
<th>Tuesday, 1:15 – 3:00, Room: St. Petersburg 2</th>
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<tbody>
<tr>
<td>Session Chair: Jason Deutsch (University of Illinois, Chicago)</td>
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<tr>
<td>Adaptive Training of Vibration-based Anomaly Detector for Wind Turbine Condition Monitoring – Takanori Hasegawa1, Jun Ogata2, Masahiro Murakawa3, Tetsunori Kobayashi4, Tetsuji Ogawa5 (1,2Waseda University, Japan; 3,4National Institute of Advanced Industrial Science and Technology, Japan)</td>
<td></td>
</tr>
<tr>
<td>Wind Turbine Intelligent Gear Fault Identification – Sofia Koukoura1, James Carroll2, Alasdair McDonald3 (1,2University of Strathclyde, UK)</td>
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<tr>
<td>Small-Scale Wind Turbine Recurrence and Cost Modeling as a Function of Operational Covariates from Supervisory Control and Data Acquisition Systems – Michael S. Czahor1, William Q. Meeker2 (1,2Iowa State University)</td>
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</table>

**Paper Session 4A: Diagnostics**

| Tuesday, 3:30 – 5:00, Room: St. Petersburg 2 |
| Session Chair: Michael Sharp (NIST) |
| Diagnostics of machine tool linear axes via separation of geometric error sources – Gregory W. Vogl1, Michael E. Sharp2 (1,2National Institute of Standards and Technology) |

**Technology Demonstrations**

<table>
<thead>
<tr>
<th>Tuesday, October 3, 2017</th>
<th>Williams &amp; Demens</th>
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<td>General Motors</td>
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<tr>
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<td>1:15 – 3:00</td>
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<tr>
<td>MathWorks</td>
<td>3:30 – 5:00</td>
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<tr>
<td>Machine Health Monitoring via Internet of Things Platform</td>
<td>3:30 – 5:00</td>
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**Wednesday, October 4, 2017**

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<th>Williams &amp; Demens</th>
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<tr>
<td>General Motors</td>
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<td>Automotive Application of PHM Concepts via Cadillac SRX Rig</td>
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<td>Life Prediction Technologies</td>
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**Annual Conference of the Prognostics and Health Management Society 2017**
<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Technical Paper Sessions</th>
<th>Technical Paper Sessions</th>
<th>Career Fair</th>
<th>Smart Manufacturing Workshop</th>
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<td>Continental Breakfast</td>
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<td>Opening Remarks</td>
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<td>Keynote Speaker: Steve Holland <em>(General Motors)</em></td>
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<td>“Issues and Opportunities in Automotive PHM”</td>
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<td>8:45 – 10:15</td>
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<td>Paper Session 5A:</td>
<td>Paper Session 5B:</td>
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<td>Aviation I</td>
<td>Data Driven Methods I</td>
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<td>Standards Workshop</td>
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<td>Brian Weiss (NIST) and Donnie Alonzo (ASME)</td>
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<td>10:30 – 12:00</td>
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<td>Paper Session 6A:</td>
<td>Paper Session 6B:</td>
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<td>Smart Manufacturing</td>
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<td>Aviation II</td>
<td>Data Driven Methods II</td>
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<td>Standards Workshop (cont’d)</td>
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<td>Brian Weiss (NIST) and Donnie Alonzo (ASME)</td>
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<td>Paper Session 7B:</td>
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<td>Systems I</td>
<td>Structural Health</td>
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<td>Paper Session 8B:</td>
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<td>Systems II</td>
<td>Anomaly Detection</td>
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<td>PHM Conference Banquet</td>
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<td>Museum of Fine Arts</td>
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**Paper Session 5A: Aviation I**
Wednesday, 8:45 – 10:15, Room: St. Petersburg 2
Session Chair: Karl Reichard *(Pennsylvania State University)*

Fast Optimization for aircraft Descent and Approach Trajectory – Dmitry G. Luchinsky¹, Stefan Schuet³, J. Brenton⁴, Dogan Timucin¹, David Smith⁵, John Kaneshige⁶ *(¹SGT, Inc.; ²NASA Ames Research Center)*

Health-Informed Uncertainty Quantifications via Bayesian Filters with Markov Chain Monte Carlo Simulations for Fatigue Critical Rotorcraft Components – Michael Shiao¹, Anindya Ghoshái *(¹Army Research Laboratory)*

Reducing the Impact of Test Bench Component on the Thrust Margin Measurement – Mohammed Meqadmi¹, Pierre-Étienne Mossër³, Thierry Brichler³, Jérôme Lacaille³ *(¹²³Safran Aircraft Engines, France)*

**Paper Session 5B: Data Driven Methods I**
Wednesday, 8:45 – 10:15, Room: St. Petersburg 3
Session Chair: Jamie Coble *(University of Tennessee, Knoxville)*

A Method for Measuring the Robustness of Diagnostic Models for Predicting the Break Size during LOCA – Xiang Tian¹, Victor Becerra², Nils Bausch³, Gopika Vinod³, T.V. Santhosh³ *(¹University of Portsmouth, UK; ²Bhabha Atomic Research Centre, India)*

Condition Monitoring of a Reciprocating Compressor Using Wavelet Transformation and Support Vector Machines – Shawn Falzone¹, Jason R. Kolodziejej² *(¹²Rochester Institute of Technology)*

Data Driven Modeling and Estimation of Accumulated Damage in Mining Vehicles using On-board Sensors – Erik Jakobsson¹, Erik Frisk¹, Robert Pettersson³, Mattias Krysanandér³ *(¹²³Atlas Copco Rock Drills AB, Sweden; ²³Linköping University, Sweden)*

Fault Detection By Segment Evaluation Based on Inferential Statistics for Asset Monitoring – Vepa Atamuradov¹, Kamal Medjahe², Benjamin Lamoureux², Pierre Dersin³, Noureddine Zerhouni² *(¹INP-ENIT, France; ²³ALSTOM Transport, France; ¹²FEMTO-ST Institute, France)*

**Paper Session 6A: Aviation II**
Wednesday, 10:30 – 12:00, Room: St. Petersburg 2
Session Chair: Yuan Di *(University of Cincinnati)*

A Case for the Use of Data-driven Methods in Gas Turbine Prognostics – Marcia Baptista¹, Cairo L. Nascimento², Helmut Prendergister³, Elsa Henriques⁴ *(¹Universidade de Lisboa, Portugal; ²Instituto Tecnologico de Aeronautica, Brazil; ³National Institute of Informatics, Japan)*

Effect of Ambient Temperature on Performance of Gas Turbine Engine – Yuan Liu¹, Avisek Banjeeje², Amar Kumar³, Alka Srivastava¹, Nita Goel² *(¹Life Prediction Technology Inc., Canada; ²³Tecsis Corporation, Canada)*

Prospective Architectures for Onboard vs Cloud-based Decision Making for Unmanned Aerial Systems – Shankar Sankaranranam³, Christopher Teubert² *(¹SGT, Inc.; ²³NASA Ames Research Center)*

**Paper Session 6B: Data Driven Methods II**
Wednesday, 10:30 – 12:00, Room: St. Petersburg 3
Session Chair: Mohamed Ismail *(Institute of Flight Systems, German Aerospace Center (DLR))*

A Compressed Sensing Feature Extraction Approach for Diagnostics and Prognostics in Electromagnetic Solenoids – Christian Knoebel¹, Hanna Wenzi², Johannes Reuter³, Clemens Guehmann³ *(¹²University of Applied Sciences Konstanz, Germany; ³Technische Universität Berlin, Germany)*

Fault Detection and Prognosis of Time Series Data with Random Projection Filter Bank – Sepideh Pourazarm¹, Amir-massoud Farahmand², Daniel Nikovski³ *(¹Mitsubishi Electric Research Laboratories)*

A Comparison of Acoustic Emission and Vibration Measurements for Condition Monitoring of an Offshore Drilling Machine –
<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Panel Sessions</th>
<th>Technology Demos</th>
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<tr>
<td>7AM – 5PM</td>
<td>Continental Breakfast</td>
<td><strong>Registration</strong></td>
<td>Williams &amp; Domeness</td>
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<tr>
<td>7:30 – 8:00</td>
<td>Opening Remarks</td>
<td>Keynote Speaker: Steve Holland <em>(General Motors)</em> “Issues and Opportunities in Automotive PHM”</td>
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<tr>
<td>8:00 – 8:45</td>
<td>Invited Session:</td>
<td>Data Challenge Winners</td>
<td>Reserved for PHM Conference</td>
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<td>Reserved for PHM Conference</td>
<td>Justinian Rosca <em>(Siemens)</em></td>
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<tr>
<td>10:15 – 10:30</td>
<td>Panel Session 5: PHM Applications Deployment</td>
<td>Tomasz Panciewicz <em>(GE Aviation)</em></td>
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<td>10:00 – 10:15</td>
<td>Break</td>
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<tr>
<td>10:15 – 10:30</td>
<td>Panel Session 6: PHM in Railway Maintenance</td>
<td>Parham Shahidi <em>(PARC)</em></td>
<td>Technology Demonstration: Automotive Application of PHM Concepts via Cadillac SRX Rig <em>(General Motors)</em></td>
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<tr>
<td>10:30 – 12:00</td>
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<td>12:00 – 1:15</td>
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<td>1:45 – 1:55</td>
<td>Break</td>
<td>Paper Session 7B: Structural Health Management</td>
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<tr>
<td>2:00 – 2:15</td>
<td>Panel Session 7: PHM Education and Standards</td>
<td>Jeff Bird <em>(TECnos)</em> and Ravi Rajamani <em>(drR² consulting)</em></td>
<td>Technology Demonstration: Model-based Predictive Maintenance Solutions for Specific Turbine Engines [Life Prediction Technologies]</td>
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<td>2:30 – 3:00</td>
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<td>3:30 – 5:00</td>
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<td>5:00 – 6:00</td>
<td>Free Time</td>
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**Social Program** on p. 17

**PHM Conference Banquet** For guest tickets, please see Registration Desk

**Greece-themed** See

**Reserved for PHM Conference**

**Data Challenge Winners**

Justinian Rosca *(Siemens)*

**Paper Session 7A: Systems I**

Wednesday, 1:15 – 3:00, Room: St. Petersburg 2

Session Chair: George Gorospe *(SGT Inc., NASA Ames Research Center)*

Inferential Framework for Autonomous Cryogenic Loading Operations – Dmitry G. Luchinskii1, Michael Khasin2, Dogan Timucin3, Jarred Sass4, Jose Perotti6, Barbara Brown4 *(1,2SGT, Inc.; 3NASA Ames Research Center; 4,5Kennedy Space Center)*

Integration of Prognostics at a System Level: a Petri Net Approach – Manuel Chiachiò1, Juan Chiachiò2, Shankar Sankararaman3, John Andrews4 *(1,2University of Nottingham, UK; 3NASA Ames Research Center)*

Why Autonomous Assets are Good for Reliability – the Impact of 'Operator-related Component' Failures on Heavy Mobile Equipment Reliability – Melinda R. Hodkiewicz1, Zac Batsioudis2, Tyler Radomiljac3, Mark T.W. Ho4 *(1,2,3University of Western Australia, Australia)*

**Paper Session 7B: Structural Health Management**

Wednesday, 1:15 – 3:00, Room: St. Petersburg 3

Session Chair: Juan Chiachiò *(University of Nottingham)*

Low Computation Acoustic Emissions Structural Health Monitoring Through Analog Signal Pre-Processing – Rune Schlansbusch1, Eric Bechhoefer2, Thomas J. J. Meyer3 *(1,2Tekniva, Norway; 2GPMS Inc.)*

Low-complexity Behavior Model for Predictive Maintenance of Railway Turnouts – Pegah Barkhordari1, Roberto Galeazzi2, Alejandro de Miguel Tejada3, Ilmar F. Santos4 *(1,2,3Technical University of Denmark, Denmark)*

Impact Damage Prediction for Wave Energy Converters – Ryan Meeke1, Stephen Adams2, Kevin Farinholt3, Nathan Hipwell4, Michael Desrosiers5, Peter Beling6 *(1,2,3University of Virginia; 4,5Luna Innovations, Inc.)*

Preliminary Results on Condition Monitoring of Fiber Ropes using Automatic Width and Discrete Length Measurements – Shaun Falconer1, Andreas Gromsrud1, Espen Oland2, Geir Grasmo3 *(1,2University of Agder, Norway; 3Tekniva AS, Norway)*

**Paper Session 8A: Systems II**

Wednesday, 3:30 – 5:00, Room: St. Petersburg 2

Session Chair: Roghieh Abdollahi *(Clemson University)*

Gear Fault Diagnostics Using Extended Phase Space Topology – T. Haj Mohamad1, C. Nataraj2 *(1,2Villanova Center for Analytics of Dynamical Systems)*

Actuator Fault-Detection for Autonomous Underwater Vehicles Using Unsupervised Learning – Matt Kemp1, Ben Raanan2 *(1,2Monterey Bay Aquarium Research Institute)*

Unobtrusive Software and System Health Management with R2U2 on a parallel MIMD Coprocessor – Johann Schumann1, Patrick Moosbrugger2 *(1SGT, Inc., NASA Ames Research Center; 2Vienna University of Technology, Austria)*

**Paper Session 8B: Anomaly Detection**

Wednesday, 3:30 – 5:00, Room: St. Petersburg 3

Session Chair: Dmitry Luchinsky *(SGT Inc., NASA Ames Research Center)*

Anomaly Detection Using Dynamical Linear Models and Sequential Testing on a Marine Engine System – Erik Vanem1, Geir Øive Storvik2 *(1DNV GL, Norway; 2University of Oslo, Norway)*

Leak Detection in Compressed Air Systems using Unsupervised Anomaly Detection Techniques – Antoine Desmet1, Matthew Delore2 *(1Komatsu Mining Corporation, Australia; 2University of Newcastle, Australia)*

Early Warnings for failing Train Axle Bearings based on Temperature – M.F.E. Peters1 *(1Netherlands Railways (NS), Nederland)*
Paper Session 9A: Standards & Methodologies
Thursday, 8:45 – 10:15, Room: St. Petersburg 2
Session Chair: Carolin Wagner (University of Münster)
Identification of Industrial Robot Arm Work Cell Use Cases and a Test Bed to Promote Monitoring, Diagnostic, and Prognostic Technologies – Brian A. Weiss1, Alexander Klingener2 (National Institute of Standards and Technology)
Trends in Research Techniques of Prognostics for Gas Turbines and Diesel Engines – Joseph T. Bernardo1, Karl M. Reichard2 (The Pennsylvania State University Applied Research Laboratory)
The Role of Transactional Data in Prognostics and Health Management Work Processes – Sarah Lukens1, Manjish Naik2, Xiaohui Hu3, Donald S. Doan4, Shaddy Abado5 (GE Digital)
A Generic Software Architecture for Prognostics – Christoph Teubert1, Matthew Daigle2, Shankar Sankararaman3, Kai Goebel4, Jason Watkins5 (NASA Ames Research Center, SGT, Inc., University of California)

Paper Session 10A: Bearings PHM
Thursday, 10:30 – 12:00, Room: St. Petersburg 2
Session Chair: Manuel Chiachío (University of Nottingham)
Challenges And Opportunities in Applying Vibration Based Condition Monitoring in Railways – Diego A. Tobon-Mejia1, Pierre Dersin2, Gerard Tripot3 (ALSTOM, France)
Steps Toward Prognostics of Faults in Bearings – Eyal Madar1, Gideon Kogan2, Dmitri Gazizulin3, Renata Klein4, Jacob Bortman5 (Ben-Gurion University of the Negev, Israel; R.K. Diagnostics, Israel)
Feature Extraction for Bearing Prognostics using Correlation Coefficient Weight – Seokgook Kim1, Chaeyoung Lim2, Joo-Ho Choi3 (Korea Aerospace University, Korea)

Paper Session 11A: Railway PHM
Thursday, 1:15 – 3:00, Room: St. Petersburg 2
Session Chair: Ian Jennions (Cranfield University)
Combination of Data-driven Feature Selection Methods with Domain Knowledge for Diagnosis of Railway Vehicles – Bernhard Girstmair1, Andreas Haigermoser2, Justinnian Rosca3 (SIEMENS AG, Austria; SIEMENS Corporate Technology)
A Reliability-based Prognostics Framework for Railway Track Management – Juan Chiachió1, Manuel Chiachió2, Darren Prescott1, John Andrews4 (University of Nottingham, UK)
Some Influencing Factors for Passenger Train Punctuality in Sweden – Carl-William Palmqvist1, Nils O. E. Olsson2, Lena Winslott Hiselius3 (Lund University, Sweden; Norwegian University of Science and Technology, Norway)
Anomaly Detection and Severity Prediction of Air Leakage in Train Braking Pipes – Wan-Jui Lee1 (Dutch Railways, Delft University of Technology, the Netherlands)

Paper Session 11B: Prognostics I
Thursday, 1:15 – 3:00, Room: St. Petersburg 3
Session Chair: Abbas Chokor (Seagate Technologies)
Remaining Useful Life prediction method using an observer and statistical inference estimation methods – Toufik Aggbai1, Frédéric Kratz2, Pascal Vrignat3, Manuel Avila4 (INSA CVL, France; Orleans University, France)
HPPN-based Prognosis for Hybrid Systems – Pauline Ribot1, Elodie Chantry2, Quentin Gaudel3 (LAAS-CNRS, Université de Toulouse, France; Easymile, France)
PFAuper: Simulation-Based Prognostics to Monitor and Predict Sparse Time Series – Javier Echazu1, Andrew Gardner2, 3Invited paper published in IJPHM (www.ijphm.org)
<table>
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<tr>
<th>Time</th>
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<th>Location</th>
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<td>8:00</td>
<td>Opening Remarks</td>
<td>Grand Bay Ballroom</td>
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<td>8:45</td>
<td>Luminary Presentation: Gilbert Haddad <em>(Sparkcognition)</em></td>
<td>Grand Bay Ballroom</td>
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<tr>
<td>9:00</td>
<td>Panel Session 1: Corrosion Assessment and Remediation</td>
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<td><em>Edward Manns (NACE)</em></td>
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<td>Lunch on your own</td>
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<td>10:30</td>
<td>Break</td>
<td>St. Petersburg Foyer</td>
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<td>11:00</td>
<td>Panel Session 9: PHM for Human Assets</td>
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<td><em>Wolfgang Fink (University of Arizona)</em></td>
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<td>1:15</td>
<td>Break</td>
<td>St. Petersburg Foyer</td>
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<td>3:00</td>
<td>Panel Session 10: Data Analytics in Commercial Aviation</td>
<td>St. Petersburg 2</td>
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<td><em>Rhonda Walthall (UTC Aerospace Systems)</em></td>
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<td>4:00</td>
<td>Break</td>
<td>St. Petersburg Foyer</td>
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<td>5:00</td>
<td>Panel Session 11: Fielded Systems Lessons Learned</td>
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<td><em>Andy Hess (The Hess PHM Group)</em></td>
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**Paper Session 12A: Electronics PHM**

**Thursday, 3:30 – 5:00, Room: St. Petersburg 2**

**Session Chair: Jeff Bird (TECnos Consulting Services)**

- Application of a Relative Humidity Sensor for Monitoring Water Vapor Concentration inside Enclosures – Brian Hatchell¹, Eric Gonzales², Anton Sinkov³, Lorenzo Luzi⁴, Azem Cakerri⁵ (¹Pelican Northwest National Laboratory; ²U.S. Army ARDEC)
- Prognosis of Connector Disconnection Using a Canary-Based Approach – Xinyu Du⁶, Atul Nagose⁷, Aaron Bloom⁸, Timothy Julson⁹ (¹General Motors)
- Impact of Modulation Frequencies on the Lifetime of Power Semiconductor Modules for EV Applications – Quentin Gestes¹, Nicolas Degrenne² (*Ecole Normale Superieure de Rennes, France*; ²Mitsubishi Electric R&D Centre Europe, France)
- An Observer-based On-line Electrolytic Capacitor Health Monitoring System – Laurent Foube¹ (*Mitsubishi Electric R&D Centre Europe, France*).

**Paper Session 12B: Prognostics II**

**Thursday, 3:30 – 5:00, Room: St. Petersburg 3**

**Session Chair: Stephen Adams (University of Virginia)**

- Spatio-temporal Probabilistic Modeling Based on Gaussian Mixture Models and Neural Gas Theory for Prediction of Criminal Activity – Francisco Jaramillo¹, Vanessa Quintero², Aramis Pérez³, Marcos Orchard⁴ (¹Universidad de Chile, Chile)

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**A Comparison of Feature Selection and Feature Extraction Techniques for Condition Monitoring of a Hydraulic Actuator**

- Stephen Adams¹, Ryan Meekins², Peter A. Beling³, Kevin Farinholt⁴, Nathan Brown⁵, Sherwood Polter⁶, Qing Dong⁷ (*University of Virginia*; ²Luna Innovations Inc.; ³Naval Surface Warfare Center)

**Improvement of a Hydrogenerator Prognostic Model by using Partial Discharge Measurement Analysis**

- Mélanie Lévesque¹, Normand Amyot², Claude Hudon³, Mario Bélec⁴, Olivier Blancke¹ (*Institut de Recherche d’Hydro-Québec, Canada; ²École de Technologie Supérieure, Canada*)

**A Bi-Level Weibull Model with Applications to Two Ordered Events**

- Shuguang Song¹, Hanlin Liu², Mimi Zhang³, Min Xie⁴ (*The Boeing Company; ²City University of Hong Kong, Hong Kong SAR; ³University of Strathclyde, UK*)

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*¹Invited paper published in IJPHM (www.ijphm.org)*

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**Mobile App**

The PHM Conference will be using the Whova mobile app this year. Easily access the most up-to-date agenda information, read full PDF versions of all papers, connect with other attendees, and much more using the free app on your phone or tablet. Get “Whova” from the App Store or Google Play and sign in with your e-mail account.

Search for the PHM2017 event and, if prompted, use passcode phmsociety.

http://whova.com/portal/phm_201710
Doctoral Symposium

Monday, 8:00 – 5:15, Room: Bayboro
Symposium Chair: Jamie Coble (Univ. of Tennessee, Knoxville)

The Doctoral Symposium provides an opportunity for graduate students to present their research interests and plans at a formative stage in their research. The students will receive structured guidance from a panel of distinguished researchers as well as comments from conference participants and fellow students in a collegial setting. The PHM Society Doctoral Symposium will be held as a workshop on the first day of the conference. The panelists for the DS are:

- Ian Jennions (Cranfield University)
- Chetan Kulkarni (NASA)
- Ravi Rajamani (drr² consulting)
- Michael Sharp (NIST)

Doctoral Symposium Session 1
Monday, 9:15 – 11:50, Room: Bayboro
A New Approach to High Impedance Fault Detection and Location for Distribution Systems – Roghieh Abdollahi (Clemson University)
Development of Deep Learning Based Prognostics for Rotating Components – Jason Deutsch (University of Illinois, Chicago)
Fleet Prognostics and Health Management – A General Process Model for Data-Driven Fleet Analytics – Carolin Wagner (University of Münster)

Doctoral Symposium Session 2
Monday, 1:00 – 2:40, Room: Bayboro
Probabilistic Life Prediction and Prognostics-Based Maintenance Optimization for Gas Pipelines – Yuhao Wang (Arizona State University)
Vibration-Based Fault Detection and Quantification for Primary Flight Control Electro-Mechanical Actuators – Mohamed Ismail (Institute of Flight Systems, German Aerospace Center (DLR))

Doctoral Symposium Session 3
Monday, 3:00 – 5:15, Room: Bayboro
Enhanced System Health Assessment Using Adaptive Self-Learning Techniques – Yuan Di (University of Cincinnati)
Development and Application of Advanced Data-Driven Methods for Prognostics and Health Management of Industrial Components under Scarce Degradation Information – Francesco Cannarile (Politecnico di Milano)

Career Fair

The career Fair is FREE and OPEN to all registered PHM17 conference participants and recruiters.
Candidates of all ages, all levels of experience, and all industries are encouraged to attend.
Candidates can email their resumes prior to the career fair to: careerfair2017@phmconference.org in order to arrange and schedule interviews with recruiters.
Recruiters will be onsite to interview and accept resumes for full-time, part-time and internship positions.
Recruiters must register for the conference.
For further details or questions on the list participants companies, please enquire at the Registration Desk.

Places are limited and will be allocated on a first-come first served basis. Register today to reserve your place! For further details or questions, please contact Abbas Chokor at careerfair2017@phmconference.org.

Smart Manufacturing Standards Workshop

Smart Manufacturing Standards Workshop
Wednesday, 8:45 – 12:00, Room: Bayboro
Workshop Chairs: Brian A. Weiss (NIST) and Donnie Alonzo (ASME)

The goal of this workshop is to build upon previous efforts to identify where the American Society of Mechanical Engineers (ASME) might develop standards and/or guidelines that would make it more efficient, cost-effective, and profitable for every manufacturer, to monitor the health of their overall factory, and not just individual machines – and predict when, where, and how maintenance will be needed. Perspectives from large manufacturers, as well as small and medium-sized manufacturers (SMMs) will be shared, current trends in emerging technologies will be discussed, and initial efforts from a prior workshop will be highlighted.

Tutorials

One of the unique features of the PHM conferences is free technical tutorials on various topics in health management taught by industry experts. As educational events tutorials provide a comprehensive introduction to the state-of-the-art in the tutorial’s topic. Proposed tutorials address the interests of a varied audience: beginners, developers, designers, researchers, practitioners, and decision makers who wish to learn a given aspect of prognostic health management. Tutorials will focus both on theoretical aspects as well as industrial applications of prognostics. These tutorials reach a good balance between the topic coverage and its relevance to the community.

Tutorial Session 1: Model-Based Prognostics—An Introduction
Tuesday, 1:15 – 3:00, Room: St. Petersburg 3
Indranil Roychoudhury
SGT, NASA Ames Research Center

Abstract: This tutorial will cover the basics of model-based prognostics, and include concepts such as modeling approaches, estimation and prediction algorithms, and how uncertainty is represented and quantified. Other topics covered will include structural model decomposition, system-level prognostics, prognostics of hybrid systems, and distributed prognostics. Several case studies, such as water recovery systems to the prediction of safety margins in the national airspace system will be used to explain different concepts of prognostics and demonstrate their application to real-world systems.
**Presenter Bios:** Dr. Indranil Roychoudhury received the B.E. (Hons.) degree in Electrical and Electronics Engineering from Birla Institute of Technology and Science, Pilani, Rajasthan, India in 2004, and the M.S. and Ph.D. degrees in Computer Science from Vanderbilt University, Nashville, Tennessee, USA, in 2006 and 2009, respectively. Since August 2009, he has been with SGT, Inc., at NASA Ames Research Center as a Computer Scientist. His research interests include hybrid systems modeling, model-based diagnostics and prognostics, distributed diagnostics and prognostics, and Bayesian diagnostics of complex physical systems. Dr. Roychoudhury is a member of the Prognostics and Health Management Society and the AIAA and a Senior Member of the IEEE.

**Tutorial Session 2: Design, Development, and Testing of PHM Software**

**Tuesday, 3:30 – 5:00, Room: St. Petersburg 3**

**Chris Teubert**

*NASA Ames Research Center*

**Abstract:** This tutorial will describe the process of designing, developing, and testing PHM software, from the definition of requirements to deployment and maintenance. The emphasis will be on the design and creation of the software product, not the PHM algorithms. Description will include real-life examples from the Diagnostics and Prognostics group at NASA Ames Research Center for the creation of a prognostics application leveraging the Generic Software Architecture for Prognostics (GSAP). Topics covered include selection of software development processes, requirement definition and management, software architecture, design, testing, and maintenance for PHM Applications. The tutorial will include open discussions where attendees are encouraged to provide input from their experiences with PHM application design. Following this tutorial, attendees should have a better understanding of the process of creating PHM applications, with recommendations and advice from individuals experienced with PHM application design.

**Presenter Bios:** Christopher Teubert is a software engineer and group lead of the Diagnostics and Prognostics group at NASA Ames Research Center. He specializes in the application of prognostics algorithms and the design of prognostics applications. He is also the principal investigator for the Generic Software Architecture for Prognostics (GSAP) and Prognostics as a Service (PaSs) projects. Christopher received his B.S. in Aerospace Engineering from Iowa State University in 2012 and is currently working on his M.S. in Computer Science and Engineering at Santa Clara University. Christopher worked as a research engineer with Stinger Ghafarian Technologies (SGT) at NASA Ames Research Center from 2012-2016 and has worked as a civil servant at NASA Ames since 2016.

**Tutorial Session 3: Electrical Power Systems Condition Monitoring for Improved Electronic Systems Health Management & System Resilience**

**Thursday, 8:45 – 10:15, Room: St. Petersburg 3**

**Patrick Kalgren**

*Singularity – Intelligence Amplified*

**Abstract:** Electrical power generation, conditioning, distribution, and management systems are critical to full operational capability of airborne, land, sea, and space systems. Prognostics and health management technologies offer the opportunity to decrease operating costs and increase availability, dependability, efficient utilization, and resilience of these critical infrastructure systems. This tutorial explores technologies and strategies to enable condition awareness and ensure reliable operations; discusses technical progress made in the recent past for electronic power systems health management, considers practical applications of the new technologies, and suggests strategies to foster industry acceptance and adoption of PHM capability in support of increasingly complex grid and microgrid energy solutions.

**Presenter Bios:** Patrick W. Kalgren is a founding partner and the manager of research & engineering at Singularity – Intelligence Amplified. He has a successful background in research and development of new technologies for electronic and power systems health management, self-aware processing systems, and decision support applications. Patrick’s contributions in electronic system prognostics and health management and novel data fusion and reasoning, combining physics-based and data driven techniques for PHM, have yielded two awarded patents and four additional patents pending. Mr. Kalgren has published more than 50 papers, and presented invited lectures and tutorials at multiple engineering society events. Patrick has a B.S. degree in Computer Engineering from Penn State University and is a member of Tau Beta Pi, The IEEE, and the American Helicopter Society.

**Tutorial Session 4: Deep Learning for PHM**

**Thursday, 10:30 – 12:00, Room: St. Petersburg 3**

**Emilien Dupont**

*Schlumberger*

**Abstract:** Deep Learning has been evolving very quickly over the last few years. This tutorial will aim to give a general introduction to modern Neural Networks and present some of the most recent techniques and why so many great success have come out of Deep Learning in recent years. We will also talk about Deep Learning in the context of PHM and how these techniques can be applied to various problems with time series data. Finally, we will discuss how to blend different types of data (e.g. text, image, time series…) into a single model in the context of predictive maintenance using Deep Learning.

**Presenter Bios:** Emilien is working as a Data Scientist in the Machine Learning team at the Schlumberger Software Technology and Innovation Center (STIC) in Menlo Park, CA. Emilien graduated with an MS in Computational and Applied Mathematics from Stanford University. Prior to this Emilien obtained a BSc in Theoretical Physics from Imperial College London. He works with applications of Machine Learning, and Deep Learning in particular, to problems in Oil and Gas. He also does research on generative models and variational inference.

**Data Challenge Winners**

**Invited Session: Data Challenge Winners**

**Wednesday, 8:45 – 10:15, Room: St. Petersburg 1**

**Session Chair: Justinian Rosca (Siemens)**

**Similarity-based Approach in Vehicle Suspension System in Fault Detection** — Chuang Li¹, Jiayang Liu², Chunhua Tian³, Pengfei Cui⁴, Minghao Wu⁵ (¹,²,⁴,⁵K2Data, China)

**Ensemble Model Based Fault Prognostic Method for Railway Vehicles Suspension System** — Sanhua Li¹, Yuan Tian², Zhaoxiang Jing³, Yizhou Huang⁴, Yafei Yang⁵ (¹,²,⁴,⁵Innovation Center for Industrial Big Data, China)

**Hybridising Data-driven and Model-based Approaches for Fault Diagnosis of Rail Vehicle Suspensions** — Chan Hee Park¹, Sooho Kim², Junmin Lee³, Dong-Ki Lee⁴, Kyumin Na⁵, Joowhan Song⁶, Byeng D. Youn¹ (¹,²,³,⁴,⁵,⁶OnePredict Ltd., Republic of Korea)

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*Annual Conference of the Prognostics and Health Management Society 2017*
Panel Session 1: Smart Manufacturing PHM  
Tuesday, 8:45 – 10:15, Room: St. Petersburg 1  
Session Chair: David Siegel (Predictronics)

Higher throughput, better product quality, and higher equipment availability, are the potential benefits that a well-designed prognostic and health management (PHM) systems can provide for manufacturing equipment and manufacturing processes. This enticing value proposition, along with a larger industry trend on the topics of Industry 4.0 and Smart Factory are sparking an increasing level of interest in PHM related technologies for manufacturing applications. This panel brings together a diverse group of speakers from original equipment manufacturers, end-users/manufacturers, and technology providers to discuss their ongoing PHM related efforts and their current technology and business challenges. Potential applications will be highlighted, such as industrial robot health monitoring, machine tool spindle and ball screw failure prediction, process-level performance monitoring and bottleneck detection, and incorporating machine health with factory-level decision making systems. Lastly, the panelist will share their thoughts on the future direction of manufacturing PHM.

Panelists:  
Mohamed AbuAli (Forcam)  
Yujuie Chen (Caterpillar)  
Xiaoning Jin (Northeastern University)  
Greg Vogl (NIST)

Panel Session 2: Human Machine Interfaces for Smart PHM  
Tuesday, 10:30 – 12:00, Room: St. Petersburg 1  
Session Chair: Jeremy Marvel (NIST)

Advancements in technology are dramatically changing the way we interact with our tools, and the face of manufacturing technology is literally changing to accommodate new processes and the technologically savvy operators working in our factories. Designs of user interfaces (UI) have moved significantly from their original function-over-form values. Currently, human-machine interface (HMI) designs are focused on the end-user, specifically how the presentation of system and process PHM is received and acted upon. These new designs take into direct account the ease-of-use, operator feedback and situational awareness, and overall user experience (UX) of working with the system. The goals of modern HMI design are thus focused on enabling the maximization of productivity while minimizing the cognitive demands of the operators. As technologies shift to accommodate new “collaborative” and “smart” philosophies, the nature of HMI is also expected to change to ensure operator interaction is more intuitive, safe, and effective.

The HMI for Effective PHM panel seeks to highlight the current state-of-the-art and metrics of evaluating the performance of HMI toward promoting and maintaining manufacturing situational awareness, and enabling operators to visualize and respond to critical system and process intelligence. The panel will also bring focus to the needs for advancing HMI solutions for the next generation of collaborative and smart technologies, applications, and consumers. The panel consists of experts representing user interface manufacturers, integrators, researchers, and solutions providers, who will share their perspectives on HMI challenges and opportunities for maximizing the effectiveness of UI for system and process PHM.

Panelists:  
Shelly Bagchi (NIST)  
Radu Pavel (TechSolve)  
David Siegel (Predictronics)

Panel Session 3: Automotive PHM and Emerging Standards  
Tuesday, 1:15 – 3:00, Room: St. Petersburg 1  
Session Chair: Steven W. Holland (General Motors)

PHM technology has entered production use in the automotive domain and is expected to become increasingly important for 1) Advanced Diagnostics and 2) True Prognostics. The scope of this panel includes the opportunities and barriers to the growth of PHM for commercial automotive and fleet applications. This panel is highly qualified to address the critical role suppliers will need to play in collaboration with the OEMs/Integrators to maximize the value to themselves but more importantly to the end customer. Effective supplier engagement will depend upon emerging standards to reduce proliferation and to manage costs.

Panelists:  
Philip Aiello (UPS)  
Luis Hernandez (Global Strategic Solutions)  
Andre Kleyner (Delphi)  
Klaus Sekot (Bosch)  
Yilu Zhang (General Motors)

Panel Session 4: PHM for the Electric Power Grid  
Tuesday, 3:30 – 5:00, Room: St. Petersburg 1  
Session Chair: Avi Gopstein (NIST)

The availability, reliability, and affordability of the electric power grid is critical to any nation’s economy. The convergent advances in computing and communications technology, together with the electric power industry’s accelerating deployment of renewable generation and storage technologies to meet environmental performance goals, present new opportunities for advanced diagnostics and prognostics to ensure a reliable electric grid. This panel explores case studies in the deployment of advanced diagnostics, health monitoring, and prognostics for electric power distribution systems, and highlights the business strategies and technical requirements for effective programs.

Panelists:  
Norman Amyot (Hydro-Quebec)  
Jamie Coble (University of Tennessee)  
James Hofmeister (Ridgetop Group)  
Sameer Vittal (GE Wind)

Panel Session 5: PHM Applications Deployment  
Wednesday, 10:30 – 12:00, Room: St. Petersburg 1  
Session Chair: Tomasz Pancewicz (GE Aviation)

The scope of modern PHM applications keeps on growing. Currently, numerous organizations from various industries are ready to make use of numerous predictive and diagnostic models at large scales, on fleets of thousands of machines, with many different configurations, operating in different regions, being managed by networks of stakeholders. The purpose of this panel is to discuss the various issues related to the deployment, management and maintenance of successful PHM applications. The panel will focus on how to create better environments for Remote Monitoring and Diagnostic (RM&D) operators, to help them make the best maintenance decisions and what kinds of feedback-loops should be built into our applications. Discussions will include if professional software engineers should be rewriting prototype models created by analytics engineers / data scientists, vs. should the code created by data scientists be allowed on production servers. Maintainability shall be addressed: how to implement, monitor and manage fleets of models at the production-level, so that they’re easy to update, fix and replace in the future. Discussions will also include how to shorten the time required from the moment the prototype-level code is ready, until the production-level code is ready, tested and deployed. The questions around the design of production-level IT
PHM systems and processes turn out to be far from trivial where this panel aims to foster constructive conversations to solve these challenges.

Panelists:
- Neil Eklund (Analatomi)
- Juan Lopez (Boeing)
- Mikhail Roshchin (Siemens)
- Dan Stair (Cazena)
- Sameer Vittal (GE Power)

Panel Session 6: PHM in Railway Maintenance
Wednesday, 1:15 – 3:00, Room: St. Petersburg 1
Session Chair: Parham Shahidi (PARC)

Railroads play an essential role in today’s global economy. As the most efficient land-based mode of transport for freight and the most reliable commuting method for passengers, both freight and passenger rail enable economies to operate reliably, safely and cost efficiently. Given the global pervasiveness of the railroads, making this transportation mode even more reliable and efficient is of paramount importance.

Emerging technologies such as Machine Learning and Big Data hold promise to unlock greater utilization by evolving existing maintenance practices towards condition-based maintenance. Mechanical assets such as locomotives and railcars as well as infrastructure assets such as tracks will benefit from this change, as maintenance and impending failure become predictable. Successful implementations include monitoring track geometry/rail condition, brake systems, and wheel health. While the predictive capabilities are improving, two important factors still require more attention for the success of Railway PHM. These include the data acquisition pipeline and the creation of value chains to offset initial investment costs and drive industry wide implementation.

This panel is made up of experts from industry and research to offer insight into both the practical and theoretical aspects implementing PHM in railroad operations. The panelists will present their unique backgrounds and discuss their experiences with Railway PHM projects and the impacts they have made. The panel will also include a discussion about the future of Railway PHM, where the panelists see the most pressing need for improvements, and where the greatest opportunities are.

Panelists:
- Brad Hopkins (Amsted Rail)
- Milad Hosseinpour (Amtrak)
- Wan-Jui Lee (Dutch Rail)
- Raphael Pfaff (FH Aachen)
- David Siegel (Predictronics)

Panel Session 7: PHM Education and Standards
Wednesday, 3:30 – 5:00, Room: St. Petersburg 1
Session Chairs: Jeff Bird (TECNos) and Ravi Rajamani (drR² consulting)
Forum link: http://www.phmsociety.org/forum/592

One of the PHM Society’s objectives is the advancement of PHM as an engineering discipline which includes standards and education. Panels on standards in development and what is needed have been conducted and documented in past conferences and a Society forum exists for exchanges (link above). SAE International as a Technical Partner has greatly contributed to these activities. The PHM Society is also a member of the US Technical Advisory Group of the ISO TC108 that covers diagnostics and prognostics.

How do standards and education come together for the PHM community? Both are enablers for individual and organizational achievement. This panel aims to examine existing methods and issues for advancing standards education in the PHM domains. Three perspectives on the body of knowledge are sought for discussion with the audience:
- Conventional standards organizations (open and commercial?)
- Industry (internal closed within supply chains?)
- Academia (open and lifelong learning?)

The panel will address generation, availability and renewal of the bodies of PHM knowledge with proprietary, commercial, supply chain realities. We will post to the Society Forum the Background and Challenges presentation in the summer to help the panelists and audience to prepare. Each panelist will conclude their presentation with three challenges to the audience (and PHM world) to salt the open discussion.

Panelists:
- Duncan Chase (Rolls Royce)
- Patrick Dallosta (Defense Acquisitions University)
- Logen Johnson (SAE International)
- Karl Reichard (Pennsylvania State University)
- Brian Weiss (NIST)

Panel Session 8: Corrosion Assessment and Remediation
Thursday, 8:45 – 10:15, Room: St. Petersburg 1
Session Chair: Edward Manns (NACE)

Corrosion is a major concern for DoD and industry as equipment age and become prone to corrosion processes. Losses due to corroding aircraft, transportation systems, oil and gas, industrial processes and many other sectors of our economy amount to billions of US dollars each year. It is imperative that new technological developments be advanced to mitigate the detrimental effects of corrosion. R&D is focusing on new coating materials to prevent corrosion as well as on novel corrosion sensing devices and means to detect and predict the extent of corrosion on critical structures and surfaces.

This panel session will examine the current status of corrosion prevention and mitigation technologies. The impact of corrosion processes on the integrity of critical equipment and processes in the oil and gas, transportation, aerospace and other industrial sectors. The panel members will present the state of the art and debate solution options.

Panelists:
- Bernard Laskowski (Analatomi)
- Brian Manty (MB-TSI)
- Rae Marie Mattis (NACE)
- George Vachtsevanos (Georgia Tech)
- Frank Zahir (US Air Force)

Panel Session 9: PHM for Human Assets
Thursday, 10:30 – 12:00, Room: St. Petersburg 1
Session Chair: Wolfgang Fink (University of Arizona)

Predictive Health Management (PHM) originated in the Aerospace Industry, basically trying to predict when what part would fail for what reason(s) to make (preventive) maintenance more efficient and cost-effective. This panel discusses contributions in the fields of wearable smart sensors, sensor-data-fusion, machine learning and data mining, prediction and diagnosis, and electronic health records and databases - all in the context of prognostics and health management for human performance on Earth and in Space. Moreover, this panel builds on the discussions of the experience and processes encountered/created by the panelists and highlights some specific challenges, needs, and wants with respect to the development and implementation of standards and guidelines pertaining to PHM in the area of human assets. This diverse group of panelists present their standards and guidelines perspectives on PHM for human assets. Conversations will include PHM's current
Panel Session 10: Leveraging Data Analytics for Digital Strategies in Commercial Aviation

Thursday, 1:15 – 3:00, Room: St. Petersburg 1
Session Chair: Rhonda Walthall (UTC Aerospace Systems)

The role of Data Analytics in aircraft health monitoring, predictive maintenance and inventory optimization is in the forefront of nearly every conversation about digital strategy and the projected growth of the commercial aviation aftermarket. The key stakeholders in this discussion are the Operators, OEMs, MROs, and Suppliers. This panel builds on the discussion and experience of these stakeholders in leveraging Data Analytics to support their initiatives for legacy aircraft and new technology aircraft.

Panelists:
- Craig Amadeo (Delta)
- Jayant Sen Gupta (Airbus)
- Steve King (Rolls Royce)
- Ken Nishiwaki (All Nippon Airways)
- Sven Porschmann (Lufthansa Technik)
- Ginger Shao (Honeywell)

Panel Session 11: Fielded Systems Lessons Learned

Thursday, 3:30 – 5:00, Room: St. Petersburg 1
Session Chair: Andy Hess (The Hess PHM Group)

Several long-term career practitioners in the fields of PHM and CBM+ will share their experiences, observations, and important lessons learned as part of this distinguished panel of experts. Much can be learned from the requirements generation, development, verification and validation, implementation, maturation, fielded use, fleet support, and enterprise-wide use of real world PHM systems. Just the development of the individual capabilities that make up a comprehensive and fully integrated PHM system; provides a large number of lessons learned - both good and bad. A recently evolving important focused area will also be explored around the question: “just who really owns the data that these systems produce”. These issues need to be discussed, documented, and viewed across the many industry sectors that are fielding PHM systems. Short presentations will be given by all panel participants that describe their particular topic area and experiences within the PHM/CBM+ domains. An open panel discussion will follow to explore some of these identified specific issues and concerns.

Panelists:
- Duncan Chase (Rolls Royce)
- Steve Holland (General Motors)
- Allen Jones (NAVAIR Propulsion and Power)
- Michele Kochoff Platt (AVNIK Defense Solutions)
- Woody Polter (Naval Surface Warfare Center)
- Ginger Shao (Honeywell)

Keynote Speakers

Keynote #1: Electric Aircraft: The Future of Flight, or a Fleeting Fancy?

Tuesday, 12:00 – 1:15
Room: Grand Bay Ballroom
Ravi Rajamani
drR² consulting

Abstract: Electric propulsion for manned flight is growing around the world with both established companies and startups competing to be the first to offer viable solutions. In this keynote we will discuss the history of electric propulsion and see how various key technologies are evolving, in as non-technical a manner as possible. Starting from lighter-than-air craft in the nineteenth century to blended-wing bodies using cryogenic components in the twenty-first, this history wends its way through solar, all-electric, and hybrid-electric propulsion architectures. In spite of various barriers to its success, this sector is growing furiously and we will try to understand why this is happening.

Speaker Bio: Dr. Ravi Rajamani established drR² consulting in 2016 to leverage more than 25 years of experience and expertise in data analytics and model-based design to help clients in aerospace and other industries solve diagnostics and prognostics issues. Prior to this, Ravi was an Engineering Director with Meggitt for 5 years, following an 11-year tenure with United Technologies Corporation, first at the Research Center, and then with its Pratt & Whitney division. Before that he was with the General Electric Company for 10 years. He was closely associated with its Research Center and its Power Generation business; but worked with all other businesses as well. Ravi has worked in the area of control and diagnostics of gas turbines and other complex systems, primarily using model-based and data-based analytical techniques. Ravi has a BTech (ME) from IIT Delhi, an MS (Automation) from IISc, Bangalore, a PhD (EE) from the University of Minnesota, and an MBA from the University of Connecticut. He has produced a book on electric propulsion; four book chapters and is working on two more; numerous papers in refereed journals and conference proceedings; has been invited to speak at conferences and institutions around the world; and has several patents to his name. He is active within SAE’s Propulsion Health Management (E-32), Integrated Vehicle Health Management (HM-1) committees, and various steering groups: IVHM, Electric-Aircraft, and Digital. He is also active in the PHM Society, serving on its board of directors, and he was the general chair of the 2014 European PHM conference in Nantes, France. Ravi is a Visiting Professor at Cranfield University, UK. He is a chartered engineer and a fellow of the IMechE in the UK. He also serves as a board member of the Edison Tech Center in Schenectady.

Keynote #2: Issues and Opportunities in Automotive PHM

Wednesday, 8:00 – 8:45
Room: Grand Bay Ballroom
Steve Holland
General Motors

Abstract: The advent of predictive analytics technology coupled with high-bandwidth telematic access to vehicles has opened the door for advancements in automotive PHM. This new paradigm offers a path to enhance diagnostic development and implementation as well. Prognostics has demonstrated the ability to dramatically improve perceived reliability from the customer’s point
of view as well as providing a host of other potential benefits. For example, the same type of information that is useful for detecting the onset of specific failure modes can also be used to enhance the vehicle validation process and to more effectively manage field issues. The need becomes ever greater as vehicles are equipped with more sophisticated control systems and advanced safety features. In the future, automotive suppliers will need to play an increasingly important role in the cost-effective implementation of prognostics by providing “health-ready components” to the OEMs. Emerging standards under development within SAE are expected to facilitate that eventuality.

Speaker Bio: Steven W. Holland is a Research Fellow at GM Global R&D and is currently responsible for technology strategy in Vehicle Health Management. He has been with GM for over 45 years and has held a wide variety of technical and executive positions in both R&D and Manufacturing Engineering. He is a Fellow of IEEE and a Member of SAE. Steve is active in SAE’s HM-1 IVHM Standards Committee & the IVHM Steering Group. He is a member of the Prognostics & Health Management (PHM) Society Board of Directors & their International Scientific Committee. He has served on a variety of industry, academic and government advisory boards and is a registered professional engineer. Mr. Holland holds technical degrees from Kettering & Stanford Universities.

Abstract: Big Data and Analytics and Digital Transformation have become some of the hottest topics in different industries over the last few years. There is a myriad of new data sources, cost of collecting and storing has declined significantly, and there is a new ‘data rush’ to extract the most value while driving business impact. Industrial companies have embraced PHM for more than a decade now, and substantial efforts have been made to leverage the data to reduce downtime, increase efficiency, reduce costs, etc. Other industries have started to adopt this recently under the name of ‘data science’, ‘big data and analytics’, or ‘digital transformation’. What can those industries learn from PHM? What are the communalities and differences? Are the lessons learned in PHM applicable to financial services? Where are we going from here and what are the missing gaps? These are some of the questions that will be addressed while drawing on the experience from different industries.

Speaker Bio: Gilbert Haddad has participated in shaping the Digital Transformation in multiple industries. Gilbert currently works with hedge funds on data science for investments, and advises a tech startup with their data science initiatives. Most recently Gilbert was a Data and Analytics Director for a multi-billion dollar fund where he led their big data and analytics organization. Prior, Gilbert was with Schlumberger, where he held the positions of Director of Digital Transformation and Global Analytics Manager. During both assignments, he led the strategy, development, execution, delivery and monetization of PHM applications within the company. Before Schlumberger, Gilbert was a Lead Data Scientist for GE Software and Analytics. He earned his Bachelor of Engineering in Mechanical Engineering from the American University of Beirut in Lebanon. He also holds a Master of Science in Mechanical Engineering from the University of Wisconsin-Madison and a Doctorate of Philosophy from the PHM center at the University of Maryland, College Park.
Fourth European Conference of the Prognostics and Health Management Society
The Muntgebouw, Utrecht, Netherlands
www.phm-europe.org

PHME2018 & PHM2018 Planning Meeting:
Thursday, October 5th
12:30 – 1:15 (during lunch)
Harbor View Room

Tenth Annual Conference of the Prognostics and Health Management Society
DoubleTree by Hilton Hotel Philadelphia Center City, Pennsylvania
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The International Journal of Prognostics and Health Management (IJPHM) is the premier online open access journal related to multidisciplinary research on Prognostics, Diagnostics, and System Health Management. This special issue is focused on the development, implementation, and evolution of standards, guidelines, and best practices relevant to condition monitoring, diagnostic, and prognostic technologies across a range of operational domains.

The development and implementation of standards have become a means of promoting more clear and accurate communication among disparate groups of people and technology. Some standards have become regulatory where they are adopted and enforced by organizations to ensure specific levels of capability or sufficiency. This not only provides benefit to the standards’ end-user community, this also provides value to other stakeholders within the supply chain (whether they are upstream suppliers or downstream customers). Conversely some standards are non-regulatory where they are typically developed by a community of eventual end-users and then subsequently, and voluntarily, adopted by the same group. Some standards may be considered rigid in definition and implementation while others are less so. Standards-related activities also include the development of guidelines and best practices; their proliferation and implementation have afforded end-users with sufficient flexibility to mold the guidelines and best practices to their specific operations, needs, and wants.

Standards, whether regulatory or not, have proven successful in multiple domains. They have been, and continue to be, developed in a range of industries including aerospace, agriculture, automotive, consumer electronics, electric power generation, machine tools, manufacturing, medical, oil & gas, robotics, transportation, and wind energy. The Call for Papers solicits articles on the following:

**Topics of Interest:**

- Survey papers highlighting existing PHM standards
- Evidence of PHM standards deployments and lessons learned
- Methods to address ‘stale’ / no longer used PHM standards
- Financial impact and burden of deploying PHM standards
- Standards developed for monitoring, diagnostic, and/or prognostic techniques
- Strategies to increase standards involvement by stakeholders
- Lifecycle of a PHM standard
- Proliferation of a standard(s) throughout a supply-chain
- Standards organizations and their respective areas of focus
- Workforce challenges faced during standards adoption
- Reconciling PHM standards needs and wants of disparate stakeholder groups
- PHM Standards vs. PHM guidelines vs. PHM best practices

**Submission Types (papers can range from 4-8 pages in length):**

**Development Briefs:** Development briefs describe an instance of a standard’s development, the resultant impacts, and lessons learned with an emphasis on the successes and challenges of the development process and how it influenced the standard’s lifecycle.

**Industry Case Studies:** Case studies are descriptive accounts of standards within operational environments or actual products. Techniques and apparatus, results obtained, and lessons learned can be included to share experience with the community.

**Survey Papers:** Survey papers are of a tutorial or review nature covering PHM standards or describe the best current practice, detailed characteristics and performance. These papers cover areas of general interest.

**Special Issue Editors:** Jeff Bird, jeffbird@rogers.com, Ravi Rajamani, ravi@drr2-consulting.com, Brian A. Weiss, brian.weiss@nist.gov

**Submission Instructions:** Please submit your manuscripts directly by going to the society webpage and follow instructions for journal submissions. There you will find an option to select the standards special issue.

**Invitation to Present:** Accepted papers are eligible for presentation at a future Annual Conference of the PHM Society

**Deadline for Submission:** February 12, 2018
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**CALCE** — The Center for Advanced Life Cycle Engineering (CALCE) at the University of Maryland is a driving force behind the development and implementation of physics-of-failure (PoF) approaches to reliability, and a world leader in accelerated testing, prognostics and health management (PHM) for electronic systems, electronic part supply-chain management, and sustainment of electronic systems. CALCE consists of over 100 faculty, staff, and students engaged in research with customers that range from military and avionics to automotive, telecom, medical, and consumer electronics. [www.calce.umd.edu](http://www.calce.umd.edu)

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The philosophy of Condition Monitoring and Diagnostic Engineering Management (COMADEM) is: Sustained Prosperity through Proactive Monitoring, Diagnosis, Prognosis and Management of all Assets. Since 1988, refereed annual international congresses and exhibitions have been successfully organized in UK, France, India, Canada, Finland, Australia, USA, Sweden, Portugal, Czech Republic, Spain, Japan, Norway. COMADEM has established and maintained its international reputation as one of the largest and most influential events of its kind. Through the publication of the International Journal of COMADEM, a number of special feature issues dealing with Quality, Reliability and Maintenance, Model-Based Diagnosis, Application of Artificial Intelligence Techniques, Intelligent Materials, Structures and Systems, Performance and Diagnosis of Rotating Machinery Systems and Components, Failure Diagnosis and Prognosis of Swedish Railway Systems, Energy and Environment, Knowledge-based Failure Diagnosis and Prognosis of Engineering Systems, Structural Health Monitoring, Failure Diagnosis and Prognosis of Mining Machinery and Systems and Estimating the Remaining Useful Life (RUL) of Industrial Assets have been published.

**Commercial Technologies for Maintenance Activities (CTMA)**, created in 1998, is a joint Department of Defense/National Center for Manufacturing Sciences effort promoting collaborative technology development, demonstration, and transition within DoD. Its objective is to ensure American troops and their equipment are ready to face any situation, with the most up-to-date and best-maintained platforms and tools available. The CTMA program has the ideal collaborative model for manufacturers, academia and DoD. We create relationships and opportunities, drive cutting edge R&D, and conduct industry intelligence from a unique perspective. Through partnerships, training, software, and business operations, CTMA can help advance industry objectives while satisfying DoD needs through demonstration of new technologies prior to full deployment.

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The IMS Center is a leading NSF Industry/University Cooperative Research Center (I/U CRC) in the area of Prognostics and Health Management (PHM). The Center has over fifteen years of experience in developing and delivering PHM solutions for a wide-range of applications. IMS Center’s mission is to enable products and systems to achieve and sustain near-zero breakdown performance, and transform maintenance data to useful information for improved productivity and asset life-cycle utilization. Since its inception, the Center has conducted over 100 successful industry and NSF supported projects, and has attracted over 80 members from all across the globe. The IMS Center was recently identified as the most economically impactful I/UCRC in NSF’s recent study titled Measuring the Economic Impacts of the NSF Industry/University Cooperative Research Centers Program: A Feasibility Study. According to this study, the Center delivered its members a $846.7 Million in combined benefits over the last ten years.

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