PHM Education and Professional Development Panel

How can we leverage existing knowledge?

Aria A&B

130- 140: Introductions and Objectives

140- 230: Four 11 minute talks with audience challenge

230- 250: Discussion, prioritization of issues

250- 300: Wrap-up and way forward

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10th Anniversary

San Diego, CA
Portland, OR
Montreal, Canada
Dresden, Germany
Minneapolis, MN
New Orleans, LA
Nantes, France

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Fort Worth, TX
San Diego, CA
Bilbao, Spain
Denver, CO
Jeju, Korea
St. Petersburg, FL
Utrecht, Netherlands
Philadelphia, PA

2009 – 2018

Panel Sessions Sponsored by

UTC Aerospace Systems

Facilitators

Jeff Bird, Nat Nataraj, Nancy Madge

PHM Society Education and Professional Development Committee

Jeff Bird, Nancy Madge, Karl Reichard

phmsociety 10th Anniversary Background

> ## PHM Society Objectives
>
> 1. Free access to PHM knowledge
> 2. Interdisciplinary and international collaboration
> 3. Advance the engineering discipline

PHM taxonomy, PHM Continuing Professional Development, standards education:

Education Forum at: www.phmsociety.org/forum/577

1. 20% of PHM knowledge change per year
2. Conference tutorials/seminars remain a priority and key discriminator
3. Access to free archival materials is important
4. Broad interest in professional development from basis of academic programs
5. Interest in generating data sets and case studies
6. Industry perspective - ongoing need to have qualified applicants and are willing to contribute to the training of new hires
7. A number of existing courses and certificates are available to help bridge skills gap

Panel Survey 2011

1. What do we need to make prognostics better? (multiple choice)

Better data based methods 4 5.4%

Better reference data 11 14.9%

Better verification and validation methods 15 20.3%

Better cost benefit assessment methods 16 21.6%

Better knowledge sharing 15 20.3%

Better experience sharing 13 17.6%

http://www.phmsociety.org/node/919

phmsociety Panel Objectives and Scope

1. Examine the kinds of training available to the PHM community.

2. Identify gaps and opportunities to access content to advance personal and organizational development aims.

3. Prioritize actions for the PHM Society through its Education and Professional Development Committee.

SCOPE- Life Long Learning

Generation, access and renewal of the bodies of PHM knowledge with proprietary, commercial, supply chain realities

- Academia

- Commercial

- Industry

Introductions

Panelists

- Dr. Nat C. Nataraj, Villanova

- Dr. Jamie Coble, University of Tennessee Knoxville

- Kathryn Elliot, Rolls Royce

- PHM Society- Jeff Bird

- Facilitators

  - Jeff Bird, Karl Reichard, Nancy Madge

PHM Needs

1) PHM is a diverse, multi-disciplinary domain with rapidly evolving capability needs.

2) Initial education and training from many disciplines must be complemented by specialized and professional development over a career.

3) Benchmarks are needed for career planners, employers and training developers to facilitate transitions between mastery levels.

4) Stakeholders in academia, industry and government want a stream of qualified practitioners.

Panel Survey Results from 2011 - 1

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1. Society training priorities should include:
 Responses and percentages

Post graduation training 9 13.2%
University curriculum inputs 6 8.8%
Certification 8 11.8%
Seminars 14 20.6%
Internships and co-ops 11 16.2%
Conference tutorials 19 28.0%

http://www.phmsociety.org/node/919

2. Plenary Introduction: Where can we contribute? Responses and %

Create a common taxonomy of PHM skills and ... 182 29.0%

Identify industry needs 161 25.6%

Identify academic opportunities 90 14.3%

Develop standards 118 18.8%

Develop certification 67 10.7%

http://www.phmsociety.org/node/919

PHM Taxonomy

Reference paper: https://www.phmsociety.org/node/1152

Domains

1. System physical modeling
2. Data Modeling
3. Analytics
4. Test and Experimental (Design and conduct)
5. Software Systems
6. Hardware Systems
7. Life Cycle Analysis
8. Verification and Validation
9. Human Factors
10. System Engineering
11. Cost Benefit Analysis
12. Certification
13. Standards

Capability

Specialty	Entry Level descriptors	Working Level descriptors	Mastery Level descriptors
Methods	Apply existing single and multi-disciplinary methods …	Assess shortcomings in existing methods- adapt/hybridize methods to suit …	Develop new methods from novel physics or mathematical insights …
Metrics	Apply appropriate existing metrics …	Adapt metrics to complex system evaluation …	Devise and approve system level metrics …

CPD: Activity Types?

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Reference paper: https://www.phmsociety.org/node/1535

1. Professional Practice
- Analysis, planning, evaluation
- Internal report
- Influencing the practice of PHM

2. Formal Learning
- Organized courses, etc. as student or instructor
- Advanced certificates, degrees, theses or certification

3. Informal Learning- with summary of learning
- Self-directed learning
- Consultation with technical experts and peers
- Conference attendance
- Technical meeting attendance
- 'Lunch and Learn' activity attendee or leader

4. Contributions to Knowledge
- External/public codes, standards, papers, …
- Conference paper reviewer, review manager
- Journal reviewer, associate editor, editor
- Technical program chair or committee
- Presentations- individual and panel
- PHM course developer

5. Participation
- Technical Conference management roles
- Technical Board or committee roles
- Mentoring as a mentor or mentee
- Community service

PHM Society Curriculum
- **Tutorials**
- **Doctoral Consortium**
- **Short Courses**
    - **Fundamentals**
    - **Data Analytics- Planned**
    - **Advanced courses?**

PHM Society Activities

Traditional to be activated

1. Panels

2. Special issues of journal and tutorials- subjects?

3. Program updates and on-line forum

4. Connections among PHMers

New initiatives

1. Complete PHM Taxonomy
2. Examine voluntary Continuing Professional Development scheme
3. Education and Professional Development Interest Group
4. *PHM EPD Web Portal*
   a. Resource compilation
   b. Dataset sharing
   c. Case study compilation

Way forward

- Education Forum at: www.phmsociety.org/forum/577
- IJPHM papers and Communications
  - Submit an abstract
- PHM Short Course(s) with Continuing Education Units
- Form an action group to
  - Share contacts
  - Address gaps and opportunities- new courses
  - Finalize PHM Taxonomy and CPD scheme
  - Exploit data sources and case studies

phmsociety PHM17 Plenary Challenges

1. Define Career Field Competencies
2. Define Certification Requirements
3. Identify Principles and Applications for Importance/application of standards based on statutory and regulatory requirements
4. Define technical processes – Guidebooks
5. Link Assessments to Competencies and Courseware
6. Move beyond Certification to and Qualification
7. Developing practical standards at a pace that meets industry need
8. Recruiting new members to Standard Committees to ensure continuity
9. Promoting awareness and adoption of standards
10. Avoidance of duplication between standards organisations, especially inconsistent guidance
11. Leverage of practical, industry experience to complement theory based education
12. Recognition of implementation challenges in educational projects

Priorities
  – What standards challenges need to be addressed now?
  – What standards challenges CAN be addressed now?
  – What standards challenges have to wait and WHY?

Issues?

1. Lifelong learning for PHM practitioners?
   Raise awareness of PHM
   Recognize needs and educate trends

2. Need a catalogue of CPD resources?

3. Targets for learning/training organizations?
   Knowledge, hands-on, …