

The American Society of Mechanical Engineers

ASME Manufacturing Standards / PHM Subcommittee Overview

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Hello everyone. I am going to present an overview on ASME's recent work in the manufacturing space, with a focus on new efforts in monitoring, diagnostics, and prognostics.

Overview

- Mission
- Standards and ASME
- New Activities Related to Manufacturing
- Monitoring, Diagnostics, and Prognostics
- Next Steps



This slide contains an overview of what I'd like to cover in the next 10 minutes. Again, I will be focusing mainly on the new effort related to monitoring, diagnostics, and prognostics.

ASME Mission Statement:

To serve diverse global communities by advancing, disseminating and applying engineering knowledge for improving the quality of life; and communicating the excitement of engineering.



Standards and Certification (S&C) Mission Statement:

To develop the best, most applicable codes, standards, conformity assessment programs, and related products and services in the world for the benefit of humanity



On the screen are currently two mission statements, one containing the Society's overall mission, and the second containing the mission statement directly related to the Standards and Certification sector. They have been aligned to complement each other in the mission of disseminating engineering knowledge. The Standards and Certification Sector best does that through the promulgation of standards.

More recently, in alignment with our mission statement, ASME has selected 5 technology areas to focus in based on market research, industry input, and relevance to the engineering community. The 5 areas are Manufacturing, Robotics, Clean Energy, Pressure Technology, and Bioengineering. Again, I'd like to focus on the specific area of Manufacturing, but Monitoring, Diagnostics, and Prognostics may cut across several of these 5 strategic areas.

Standards and ASME

- Engineering standards have been developed to improve public safety. Standards also allow for uniform consistency of products, and help ensure fair and free commerce and trade
- ASME Standards and Certification relies on industry, academia, and government agency supporting participation by knowledgeable experts
- Not funded by industry or government
- Standards are considered voluntary unless adopted into law by a regulatory authority



Volunteer participation is key to committee operation and performance – all of the standards are written and approved by a balanced committee of subject matter experts who volunteer their time and expertise to help develop these standards.

The standards development process is not funded by the government or the industry and all standards are considered voluntary unless they are adopted into law by a regulatory authority.

ASME offers various other options in addition to the STANDARD that may help provide the industry with material, but may ease hesitation about the standardization in an emerging technology. This may include guidance in the form of a draft standard for trial use, which is essentially a “pre-standard”, provided to the industry for a set period of time during which feedback may be provided to ASME that will be used in a future revision.

Other possibilities include white papers, technical reports, and guidelines. Lexicons and terminology documents may also be a part of this subset.

Standards development has historically been a very reactive process, much like with

the development of the Boiler and Pressure Vessel Code, waiting until the technology is well-developed or when safety concerns arise before considering standardization; more recently, S&C involvement in new tech areas is much earlier. Because of the earlier involvement of ASME in standards development, more input is required and more participation and voices are required, especially for those areas that some may feel are not yet ripe for standardization.

New Activities Related to Manufacturing

- **Monitoring, Prognostics, and Diagnostics (Process PHM)**
- Model Based Enterprise (MBE)
- V&V 50 – Verification and Validation in Computational Modeling for Advanced Manufacturing
- Y14.46 – Product Definition for Additive Manufacturing
- Y14.47 – Model Organization Schema Practices
- B89.4.23 – X-ray Computed Tomography (CT) Performance Evaluation Standard



These are just a few examples of areas that ASME has recently begun to spearhead that may be of interest to this group and are directly related to manufacturing. I will talk a bit more in-depth on the Process PHM efforts in the subsequent slides.

Monitoring, Diagnostics, and Prognostics

- Effort began in June 2017 at a workshop held in conjunction with the Manufacturing Science and Engineering Conference (MSEC)
- Held second workshop in October 2017 at PHM Society Conference
- Held ASME Standards Meeting at May 2018 Industry Forum at NIST
 - Developed action plans for 3/7 topic areas



Since the beginning of this effort in June 2017, we have been mostly focusing on idea generation and brainstorming. We held the first standards meeting at May 2018 in conjunction with NIST where we expanded on the 7 topic areas which I will discuss a little bit about on the next slide.

Monitoring, Diagnostics, and Prognostics

- 7 Priority Areas:

- Standardized Terminology for PHM Guideline on Data and Collection Strategies
- Guideline to Determine what Health Data to Capture and Collection Strategies to Employ
- Guideline to Determine what Sensors and Where they should be deployed to inform on process/equipment health
- Guideline for implementing sensor data fusion/multi-modal data fusion
- Guideline to determine when and where PHM should be added/integrated
- Expand MTConnect/Data Communications
- Guideline to determine where to Perform PHM Analyses



There are 7 priority topic areas that the subcommittee is focused on expanding.

The first topic area is on terminology: this will be useful for the community in providing a common language; in developing the content for this first priority topic area, we want to leverage the work that has already been done in the standards landscape. This includes, as a first step, a deep review of terminology already existent in other standards and the landscape. The subcommittee then hopes to expand on PHM Terms.

The second topic area is on what health data to capture: this guideline may also include a cost and risk evaluation matrix to help determine this data.

The third topic area will provide guidance on sensor function and the depth of expedition; perhaps providing a case study or steps explaining how to go about sensor identification.

The fourth topic area is a guideline to support the fusion of multiple sensor data streams to generate a meaningful analysis of equipment or process health.

The fifth topic area guideline is also expected to document common operational use cases and needs, define clear roles and responsibilities within an organization to effectively execute PHM Functions and enable the development of cost justifications for implementing PHM.

The 6th topic area is a guideline that serves as a companion to the MT Connect standard to aid the standardization of communications of PHM data, especially since MT Connect is more widely used in the manufacturing community.

The 7th topic area determines where to perform phm analyses (within the organization, external to the organization) as well as (locally, in the cloud, etc.). Who ultimately has the control? This guideline hopes to include information on ownership and governance of the data.

Monitoring, Diagnostics, and Prognostics Subcommittee

- Charter
 - Develop guidelines that advance the design and implementation of monitoring, diagnostic, and prognostic capabilities, along with ways of verifying and validating their performance, to enhance adaptive maintenance and operational control strategies within manufacturing.
- Approved by the Board on Standardization and Testing in June 2018
- Welcoming Industry Participation



Next Steps

- May 2018 Standards session helped to develop action plans for three topic areas
- Holding ASME Standards PHM Meeting, October 25-26, 2018 in Cincinnati, OH at TechSolve
 - Finalizing work breakdown structure
 - Continue to develop action plans, guideline outlines, and schedule of development
 - Meeting is open to the general public
- Any interested individuals, please contact me (Donnie Alonzo) at alonzod@asme.org



Volunteering on an ASME standards development committee provides many benefits including being able to help shape new guidelines and standards based on your understanding of best practices and methodologies.