



*SETTING THE STANDARD*

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# ASME Additive Manufacturing Standards

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**Kathryn Hyam**

Project Engineering Manager

ASME Nuclear and Standardization S&C

Additive Manufacturing For Reactor Materials & Components

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# New Activities Related to Manufacturing

- Y14.46 – Product Definition for Additive Manufacturing
- Y14.47 - Model Organization Schema Practices
- Y14.48 - Universal Direction and Load Indicators
- B46 - Classification and Designation of Surface Qualities – for items made by additive manufacturing
- B89.4.23- 201x X-ray Computed Tomography (CT) Performance Evaluation Standard
- V&V 50 – Verification and Validation in Computational Modeling for Advanced Manufacturing
- Model Based Enterprise (MBE)
- Pressure Retaining Equipment – Additive Manufacturing

# Y14 Engineering Product Definition and Related Documentation Practices

- Charter: The development and maintenance of national standards for defining and documenting a product throughout its life cycle and related certification activities. This shall be accomplished by:
  1. recognizing the continuing need for existing standards regardless of the source medium (e.g., paper, film, and digital) or method of preparation (e.g., manual or computer generated);
  2. providing standardization where a variety of practices exist within industry and government;
  3. providing standards for new concepts and technologies; and
  4. supporting and coordinating development and harmonizing of standards with responsible standardization bodies, including ANSI, ISO, and government agencies.

# Y14.46 – Product Definition for Additive Manufacturing

- Charter: Standardization of dimensioning and tolerancing methods, systems, and indications on engineering product definition digital data sets promotes uniform practices and should facilitate a common interpretation of these requirements
- Subcommittee formed in in October 2014
- 25 members from throughout industry and academia, with collaborating government agencies:
  - NIST
  - US Army
  - NAVAIR
  - Office of Naval Research

# Y14.46 – Product Definition for Additive Manufacturing

- Supplements the requirements of Y14.5 and it addresses methods to control the product definition for Additive Manufacturing such as supporting structures, assemblies, embedded components, test coupons and heterogeneous materials. The standard establishes methods to specify AM process specific characteristics (e.g. build orientation and placement) that affect the product definition.
- Document was recently published as a DRAFT STANDARDS FOR TRIAL USE.
- A free Webinar is scheduled for January 10, 2018 on the document  
<https://shop.asme.org/Registrations/Conference/Y1446JAN18>

# Y14.47 - 3D Model Data Organization Schema Practices

- The Standard establishes a schema for organizing information in a model within a digital product definition data set when conveying the product definition in a Model Based Enterprise (MBE). The schema defines a common practice to improve design productivity and to deliver consistent data content and structure to consumers of the data.
- This schema document was developed to provide a set of reference standards and guidelines for the CAD user. The Draft is based on Appendix B of MIL-STD-31000A, Technical Data Packages (TDP).
- The need for this standard was identified in the ANSI/America Makes gap analysis.

# Y14.47 - 3D Model Data Organization Schema Practices

- The Subcommittee was formed in October 2013.
- There are 23 members on the subcommittee.
- The document has been Standards Committee approved but recently received a Public Review comment. Subcommittee met in October 2017 and has prepared a resolution of the comments. Will be balloted again.
- Once ANSI approved, this standard is expected to be published in the first half of 2018.



# Y14.48 - Universal Direction and Load Indicators

- Charter: Standardization of methods to unambiguously define and specify directions, directional requirements, loads, and loading requirements in product definition data sets.
- The standard will add more tools for the designer to address direction on their drawing and model (e.g., direction of the Additive Manufacture build).
- Subcommittee formed in October 2016
- Eight Members on the Subcommittee
- Held their first face-to-face SC meeting in October 2017
- An initial draft was prepared by a volunteer and will be reviewed by the subcommittee.

# B46 - Classification and Designation of Surface Qualities

- B46.1 defines surface texture and its constituents: roughness, waviness and lay, and parameters for quantifying surface texture.
- The terms and ratings in this standard relate to surfaces produced by such means as abrading, casting, coating, cutting, etching, plastic deformation, sintering, wear, erosion, etc.
- The current measurement and analysis methods were developed primarily to characterize surfaces created by conventional machining and grinding. The surfaces created by Additive Manufacturing have distinctly different geometric characteristics.

# B46 - Project Team 53

## Surface Finish for Additive Manufacturing

- Formed in October 2015 in response to an identified need noted in the ANSI/American Society of Mechanical Engineers gap analysis.
- A survey was sent to related ASME committees and other requesting input on Surface Finish needs in the Additive Manufacturing field. The Survey results have been compiled and are being analyzed.
- The Project Team usually hold two face-to-face meetings a year and teleconference in between meetings
- Work is currently focused on two documents: White paper and Functional Correlation document

# B89 – Dimensional Metrology

- Charter: The calibration, performance evaluation, uncertainty evaluation, and specification of dimensional measuring instruments and gages and the methods of their use for measuring various geometrical characteristics such as lengths, plane surfaces, angles, circles, cylinders, cones, spheres, and tori, as well as profiles.
- Standards, Guidelines and Technical Papers on the following:
  - B89 Division 1 - Length
  - B89 Division 3 - Geometry
  - B89 Division 4 - Coordinate Measuring Technology
  - B89 Division 5 - General Principles and Definitions
  - B89 Division 6 - Environment
  - B89 Division 7 - Measurement Uncertainty

# B89.4.23 - X-ray Computed Tomography (CT) Performance Evaluation Standard

- This standard specifies the dimensional measurement accuracy of X-ray computed tomography (CT) systems for point-to-point length measurements of homogeneous materials.
- The Standard is applicable to dimensional measurements made at the surface of the workpiece, i.e. at the workpiece material – air interface, including those of internal cavities. The evaluation of workpieces composed of multiple materials or of “density gradient” measurements, e.g., gradual density variations within the material, is outside the scope of this Standard.
- The document is approximately 85-90% complete and should be balloted after the next face-to-face meeting in April 2018.

# Verification & Validation of Computational Modeling

- Charter: Coordinate, promote, and foster the development of standards that provide procedures for assessing and quantifying the accuracy and credibility of computational models and simulations.
- V&V Subcommittees
  1. V&V 10 Verification and Validation in Computational Solid Mechanics
  2. V&V 20 Verification and Validation in Computational Fluid Dynamics and Heat Transfer
  3. V&V 30 Verification and Validation in Computational Simulation of Nuclear System Thermal Fluids Behavior
  4. V&V 40 Verification and Validation in Computational Modeling of Medical Devices
  5. V&V 50 Verification and Validation of Computational Modeling for Advanced Manufacturing
  6. V&V 60 Verification and Validation of Computational Modeling in Energy Systems

# V&V 50 – Computational Modeling for Advanced Manufacturing

- Charter: To provide procedures for verification, validation, and uncertainty quantification in modeling and computational simulation for advanced manufacturing.
- Subcommittee was formed in March 2016 and currently about 33 members including members from FDA, FAA, and NASA, as well as major National Labs
- V&V 50 Subgroups – recently formed on:
  1. Terminology, Concepts, Relationships and Taxonomy for VVUQ in Additive Manufacturing
  2. V&V Interactions with the Model Life Cycle
  3. VVUQ Challenges and Methods in Systems of Models
  4. VVUQ Methods in Data-driven and Hybrid models
  5. VVUQ Applications in Process Technologies

# Model Based Enterprise (MBE)

- Proposed Charter: Development of standards that provide rules, guidance, and examples for the creation and use of model-based digital datasets, data models, and related topics within a Model-Based Enterprise (MBE).
- Concern use of the model from cradle to grave – from the concept stage, through design, to manufacturing, inspection, to customer feedback and retirement
- The MBE effort supports Additive Manufacturing



# Pressure Retaining Equipment – Additive Manufacturing

- The Board on Pressure Technology Codes & Standards (BPTCS) and the Board on Nuclear Codes and Standards (BNCS) have identified the potential need/use of Additive Manufacturing (3D Printing) as a process for the construction of pressure equipment.
- BPTCS/BNCS have formed a Special Committee on Use of Additive Manufacturing for Pressure Equipment

# Questions?