America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

Launch of Phase 2
August 17, 2017 Webinar
Today’s Agenda and Speakers

- AMSC Overview
  - Jim Williams, President, All Points Additive, and AMSC Chair
- Roadmap Layout
  - Jim McCabe, Senior Director, Standards Facilitation, ANSI
- Phase 2 Preparation
  - Lauralyn McDaniel, Industry Manager, Medical, SME, and AMSC Vice Chair
- Q&A
America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

AMSC Overview
Jim Williams
President, All Points Additive
AMSC Chair
The Need for a Standardization Roadmap for Additive Manufacturing

- A number of standards developing organizations (SDOs) are engaged in standards-setting for various aspects of additive manufacturing (AM)

- Coordination is needed to maintain a consistent, harmonized, and non-contradictory set of AM standards and specifications

- Prior to 2016, there was no process for identifying priorities and interdependencies in the development of AM standards and specs
America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

- Formally launched in March 2016

- America Makes is the nation’s leading and collaborative partner in AM and 3D printing technology research, discovery, creation, and innovation

- ANSI is the national coordinating body for voluntary standardization in the United States, with a history of serving as a neutral facilitator to identify standards needs

- National Institute of Standards and Technology (NIST), U.S. Department of Defense (DoD), Federal Aviation Administration (FAA), several SDOs, were instrumental in formation of AMSC
AMSC Purpose

- To coordinate and accelerate the development of industry-wide additive manufacturing standards and specifications, consistent with stakeholder needs, and thereby facilitate the growth of the additive manufacturing industry.

- AMSC’s charter does not include developing standards or specifications; rather, the hope is to help drive coordinated activity among SDOs.
AMSC Objectives

- Coordinate and provide input to AM SDOs
- Encourage liaisons between them
- Clarify the current standards landscape
- Avoid duplication of effort
- Drive coordinated standards activity
- Better inform decision-making on resource allocation for standards participation
- Establish a common framework of AM standards and specs
- Provide subject matter experts to work with SDOs to accelerate the development of AM standards and specs
AMSC Deliverables

- **AMSC Standardization Roadmap for Additive Manufacturing, Version 1.0 (February 2017)**
  - Identifies existing standards and specifications, as well as those in development, assesses gaps, and makes recommendations for priority areas where there is a perceived need for additional standardization

- **AMSC Standards Landscape**
  - A list of standards that are directly or peripherally related to the issues described in the roadmap

- Both available as free downloads on [www.ansi.org/amsc](http://www.ansi.org/amsc)
AMSC Topical Areas

- Design
- Process and Materials
  - Precursor Materials
  - Process Control
  - Post-processing
  - Finished Material Properties
- Qualification & Certification
- Nondestructive Evaluation
- Maintenance
AMSC Phase 2 Goals

- Expand discussion beyond metals to polymers and other materials
- Engage experts from other sectors (e.g., automotive, heavy equipment, energy, industrial and commercial machinery)
  - Phase 1 participants largely drawn from aerospace, defense and medical sectors
  - Participation open to additive manufacturing stakeholders that have operations in the U.S.
  - Membership in America Makes and ANSI is not a prerequisite
- Identify overlooked gaps
- Update of progress on gaps already identified
- Publish Roadmap Version 2.0 by June 2018
America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

Roadmap Layout
Jim McCabe
Senior Director, Standards Facilitation
American National Standards Institute
Roadmap Layout

- Summary Table of Gaps and Recommendations
- Introductory Information / Overview of SDO work programs
- Gap Analysis of Standards and Specifications
- Next Steps
- Glossary
### Examples of SDOs Already Involved or Getting Involved in AM Standardization

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<thead>
<tr>
<th>SDO Name</th>
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<tr>
<td>ASTM International</td>
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<td>International Organization For Standardization</td>
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<td>America Makes</td>
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Organization of Topical Areas

- Description of the relevant subtopics and issues
- Identification of published or in development standards and specifications
- Statement as to any standards gap(s)
  - A “gap” means no published standard or specification exists that covers the particular issue in question
- Recommendation(s) how to fill the gap(s)
- A determination if additional R&D is needed
- Indication of the priority for action (high, medium, or low priority)
- Identification of an organization(s) that potentially can address the gap both for R&D and developing the standard
<table>
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<tr>
<th><strong>Gap M1: AM Analyses in RCM and CBM.</strong> Standards for AM analyses in Reliability Centered Maintenance (RCM) and Conditioned Based Maintenance (CBM+) are needed.</th>
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<tr>
<td><strong>R&amp;D Needed:</strong> No</td>
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<td><strong>Recommendation:</strong> Update SAE JA1012 RCM, a guide to provide analytics for AM trade-offs in RCM and CBM+.</td>
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<td><strong>Priority:</strong> Medium</td>
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<td><strong>Organization:</strong> SAE, ISO, ASTM</td>
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Design

- Design Guides
- Design Tools
- Design for Specific Applications
  - Design for Assembly
  - Design for Printed Electronics
  - Design for Medical
- Design Documentation
- Design Verification and Validation
Precursor Materials

- Storage, Handling and Transportation
- Characterization
  - Chemical composition
  - Flowability
  - Spreadability
  - Density (apparent vs. tapped)
  - Particle Size and Particle Size Distribution
  - Particle Morphology
  - Feedstock Sampling
  - Hollow Particles and Hollow Particles with Entrapped Gas
- AM Process-Specific Metal Powder Specifications
Process Control

- Digital Format and Digital System Control
- Machine Calibration and Preventative Maintenance
- Machine Qualification
- Parameter Control
- Adverse Machine Environmental Conditions: Effect on Component Quality
- Precursor Material Handling: Use, Re-use, Mixing, and Recycling Powder
- Precursor Material Flow Monitoring
- Environmental Health and Safety: Protection of Machine Operators
- Configuration Management: Cybersecurity
- Process Monitoring
Post-processing

- Heat Treatment (metals)
- Hot Isostatic Pressing (HIP) (metals)
- Surface Finish (Surface Texture) (metals, polymers)
- Machining (metals, polymers)
- Post-curing Methods (polymers)
Finished Material Properties

- Mechanical Properties
- Component Testing
- Bio-compatibility & Cleanliness of Medical Devices
- Chemistry
- Design Allowables
- Microstructure
Qualification & Certification

- Identified Guidance Documents
  - FDA Guidance on Technical Considerations for AM Devices
  - Lockheed Martin AM Supplier Quality Checklist
  - Aerospace Corp Mission Assurance Information Workshop
  - AWS D20
  - ASME Y14.46

- User-Group/Industry Perspectives on Q&C
  - Perspectives from Aerospace, Defense, Medical Industries
Nondestructive Evaluation (NDE)

- Common Defects Catalog Using a Common Language for AM Fabricated Parts
- Test Methods or Best Practice Guides for NDE of AM Parts
- Dimensional Metrology of Internal Features
- Data Fusion
Maintenance

- Standard Repair Procedures
- Standard Technical Inspection Processes
- Model-Based Inspection
- Standards for Tracking Maintenance Operations
- Cybersecurity for Maintenance
- Finishing and Assembly, Welding, Grinding, Coating, Plating
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Phase 2 Preparation
Lauralyn McDaniel
Industry Manager, Medical, SME
AMSC Vice Chair
Prep for 9/7 Meeting

- Familiarize Yourself with the Roadmap

Ask Yourself These Questions in re: the Roadmap

- What are the Top Roadmap Gaps for Your Sector?
- What Issues are Not Covered in the Roadmap?
- Any Suggested Changes to Roadmap’s Organization?
- Any Suggested Changes to AMSC Working Group Structure / Process for Updating the Document?
Ask Yourself These Questions in re: AM Standardization

- What areas of AM Standardization are Not Being Addressed?
- What Overlap or Duplication Exists in AM Standardization?
- What Obstacles Prevent You from Participating in AM Standardization?
At 9/7 Meeting

- Proposed Breakout Groups (subject to review at meeting)
  - Group 1 - Aerospace/Defense
  - Group 2 - Medical
  - Group 3 - Automotive/Heavy Equipment
  - Group 4 - Energy
  - Group 5 - Industrial & Commercial Machinery

- A Facilitator Will be Identified to Chair each Group
  - Ask Someone to Serve as Note-taker
  - Ask Someone to Do the Report Back

- Answer Questions on Prior Slides but Keep Discussion at a High Level - Stay out of the “Weeds”
Questions

- Don’t Forget to Register [www.ansi.org/amsc](http://www.ansi.org/amsc)!