Accelerating Standards Development

America Makes and ANSI Additive Manufacturing Standardization Collaborative (AMSC)

ANSI American National Standards Institute

America Makes

AM

AMSC Mission and Goals

- Launched in March 2016
- Drive coordinated standards activity among AM Standards Developing Organizations (SDOs)
  - Avoid duplication of effort
  - Encourage liaisons between SDOs
  - Provide subject matter experts to help SDOs develop the standards
  - Better inform decision-making on resource allocation for standards participation and R&D needs
- Clarify the current and desired future standardization landscape
- Establish a common framework of AM standards and specs
- AMSC does not develop standards

ASMC PURPOSE

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

Evolution of Roadmap

- **Feb 2017 (v1)** – heavy focus on metallic AM for aerospace, defense and medical industries
- **Jun 2018 (v2)** – added polymer content, electronic and electrical products industry
- **Jul 2023 (v3)** – added data WG, perspectives from additional industry sectors, more gaps metadata to enhance indexing/search capabilities, current alternatives being used until a standard is available, R&D expectations

AMSC Roadmap v.3

- **AM Lifecycle Areas:**
  - Design, Precursor Materials, Process Control, Post-processing, Finished Material Properties, Qualification & Certification (Q&C), Nondestructive Evaluation (NDE), Maintenance and Repair, Data
- **Background Information**: AM issues, standards, specifications, codes, regulations, etc. that are published or in development
- **141 Gaps:**
  - **Recommend**: New / revised standards, organizations that can do the work, and priority levels
  - **Identify:** Captures any pre-standardization research & development (R&D) needs
  - **Suggest:** Intended applicability to sectors, materials, lifecycle/Q&C areas, process categories
- **Participation**: Approximately 300 individuals / 150 organizations

Significant Changes in Roadmap v3

2.2.1 Precursor Materials

- Addresses Use, Re-Use Mixing, Recycling Feedstock (previously under Process Control)

2.2.2 Process Control

- Revisions to Machine Qualification/Re-Qualification, Stratification, In-Process Monitoring
- Powder Blending and Powder Mixing Terminology (NEW)

2.2.3 Post-processing

- Added ceramics
- Environmental Health and Safety Hazards (NEW)

2.2.4 Finished Material Properties

- Terminology (NEW)
- Broke down Material Properties into Specification Content Requirements, Metals, Non-metals, and Test Methods
- Reworked Material Allowables section
- AM Defect Structures (NEW)

Significant Changes in Roadmap v3

2.3 Qualification & Certification

- Q&C Framework: Prescriptive vs Performance-based (NEW)
- Additional industry guidance documents
- Broke aerospace into spaceflight and aviation
- Added energy sectors
- Sector approaches content restructure (materials, processes, machines, parts, personnel, etc.)
- Conclusions (NEW)

Significant Changes in Roadmap v3

2.4 Nondestructive Evaluation (NDE)

- New subsections on Terminology and Equipment Standardization and Demonstration of NDE Capability under Common Defects Catalog
- New subsections under Test Methods/Best Practice Guides
- Added NDE of Ceramics and Composite Materials
- New section on Effect-of-Defect of Technologically Important AM Defects
- New section in In-Service NDE

New Chapter 2.6 on Data

Technical Areas

- 2.6.2 Data Formats and Representation
- 2.6.3 Data Registration, Fusion, and Visualization (managing data sets)
- 2.6.4 Data Management
- 2.6.5 Data Quality
- 2.6.6 AM Value Chain Data Usage and Management
- 2.6.7 AM Data Security & IP Protection
- 2.6.8 Data Architecture Integration and Interoperability
- 2.6.9 Sector Related Needs

Breakdown of Open Gaps

Section	High Priority (0-2 years)	Medium Priority (2-5 years)	Low Priority (5+ years)	Total
Design	8	11	2	21
Precursor Materials	2	9	8	19
Process Control	2	8	3	13
Post-processing	1	4	3	8
Finished Material Properties	9	0	1	10
Qualification & Certification	13	10	3	26
Nondestructive Evaluation	5	6	1	12
Maintenance & Repair	1	4	2	7
Data	13	12	0	25
Total	**54**	**64**	**23**	**141**

91 Gaps Require R&D / 60 New Gaps

Next Steps

- Increase awareness about roadmap availability and recommendations, especially to recommended organizations listed in the gaps
  - Add to agendas to Standards/Codes developing organizations technical committee meetings
  - Brief research organizations during project development phases
  - Outreach to AM stakeholders / individual organizations and related government bodies
  - Social media and other communication channels
    - Press Release
    - Roadmap (freely available / direct link)
- Collaborate to close gaps!

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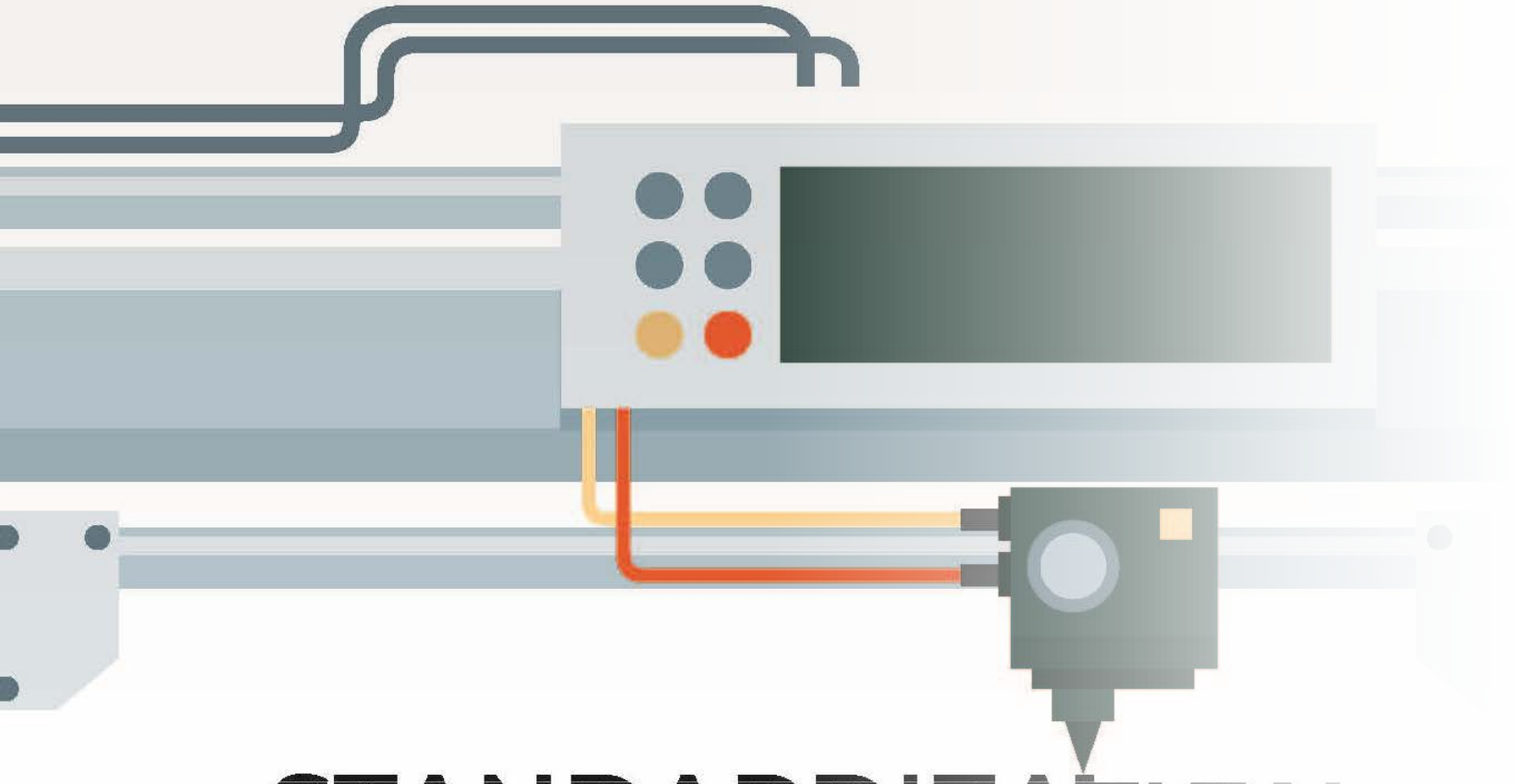
Standardization Collaboration

One way ANSI coordinates and supports the standardization system is through **standards collaboratives and workshops**, which:

- Bring together the public and private sector in a **neutral forum**
- Identify current and in-development standards, where gaps exists, and recommend solutions
- Identify organizations that can perform the needed work

ANSI does **NOT** write standards

Founded in 1918, ANSI is a private non-profit membership organization whose mission is to enhance U.S. global competitiveness and the American quality of life by promoting, facilitating, and safeguarding the integrity of the U.S. voluntary standardization system.



STANDARDIZATION ROADMAP FOR ADDITIVE MANUFACTURING

Contact Information

Christine D. Bernat
Associate Director,
Standards Facilitation
1-202-236-7580 *(m)*
cbernat@ansi.org
amsc@ansi.org