

America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC)

Roadmap Version 3 Kickoff
September 22, 2022

Welcome!

- § This event is being recorded and a publicly accessible link to the recording on the [AMSC page](#) will be made available for those unable to attend today's meeting. If you do not wish to be recorded, keep your audio on mute and your camera off throughout the event.
- § All attendees (audience members) are muted on entry
- § We will hold Q&A until after the presentations
- § For the Q&A period, attendees may either:
 - § Type your question into the chat (please send it to All Panelists)
 - § Use the "raise hand" feature in the Participants panel to speak
 - § Staff will individually unmute those who wish to speak
 - § Remove raised hand after you ask your question
- § Slides will be made publicly available

Today's Agenda



Opening Remarks - America Makes

Brandon Ribic, Technology Director, America Makes



Opening Remarks - AMSC Chair

Doug Wells, NESC Deputy Technical Fellow for Materials, Damage Tolerance Assessment Branch, NASA Marshall Space Flight Center



AM Standards Roadmap - Industry Perspective

Jesse Boyer, Fellow - Additive Manufacturing, Pratt & Whitney



AM Standards Roadmap - Government Perspective

Shawn Moylan, Mechanical Engineer, National Institute of Standards and Technology (NIST)



AMSC Overview & How to Engage

Jim McCabe, Senior Director, Standards Facilitation, American National Standards Institute (ANSI)



Quick Recap: 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

Many SDOs Interested in Additive Manufacturing

ASTM
International



International
Organization
For
Standardization



American
Society of
Mechanical
Engineers



SAE International



American
Welding
Society



Institute of
Electrical and
Electronics Engineers



Association for
the Advancement
of Medical
Instrumentation



Metal Powder
Industries
Federation



Underwriters
Laboratories,
Inc.



IPC -
Association
Connecting
Electronics
Industries



AMSC Background

- § Launched in March 2016

- § [America Makes](#) is the nation's leading public-private partnership for additive manufacturing (AM) technology and education

- § [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

- § Several agencies & organizations involved in formation of AMSC
 - § National Institute of Standards and Technology (NIST)
 - § U.S. Department of Defense (DoD)
 - § Federal Aviation Administration (FAA)
 - § Several SDOs

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

AMSC Goals

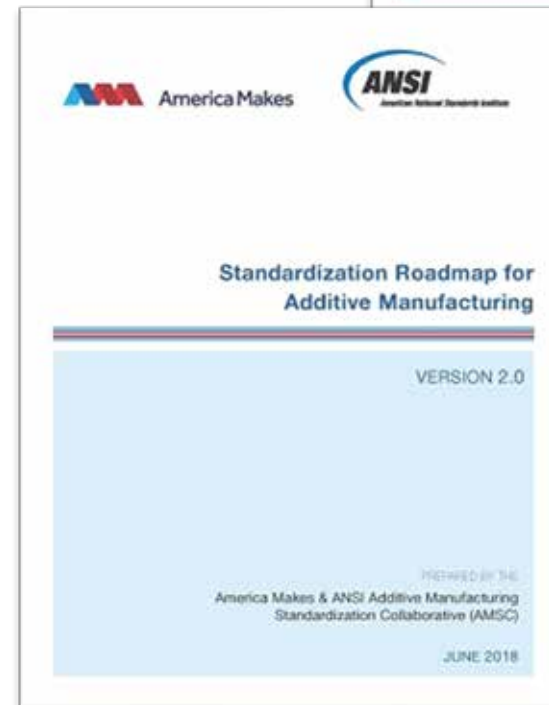
- § Drive coordinated standards activity among AM SDOs
- § Encourage liaisons between SDOs
- § Clarify the current standards landscape
- § Avoid duplication of effort
- § Better inform decision-making on resource allocation for standards participation
- § Establish a common framework of AM standards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

AMSC Participation

- § Participation is open to AM stakeholders that have operations in the U.S.
- § Membership in America Makes and ANSI is not a prerequisite
- § Members include:
 - § Original Equipment Manufacturers (OEMs)
 - § Feedstock Material Producers
 - § User Stakeholders - Industry and Government
 - § R&D Community - Academia and Government
 - § SDOs
- § More than 300 individuals from 175 public- and private-sector organizations involved in v2
 - § Draws from aerospace, defense, medical and other sectors
- § Work overseen by AMSC advisory group: industry, government, and standards developing organization (SDO) representatives

Selected AMSC Milestones / Accomplishments

- § 31 Mar 2016 | inaugural meeting
- § 26 Sep 2016 | 2nd meeting
- § **28 Feb 2017 | roadmap v1 published**
- § 9 May 2017 | standards forum @ RAPID + TCT
- § 7 Sep 2017 | v2 kickoff
- § **28 Jun 2018 | v2 published**
- § 14 Nov 2018 | standards forum @ Formnext
- § 18-19 Jun 2019 | DoD AMMO session
- § 29 Oct 2019 | SAE IIM session



Recent AMSC Activities - Virtual Events & Tracking Progress to Address Roadmap Gaps

Virtual Events

- § 10 Dec 2020 | [Process control to enable qualification](#)
 - § 31 Mar 2021 | [Design for AM](#)
 - § 13 Jul 2021 | [Feedstock materials](#)
 - § 8 Dec 2021 | [Inspection / monitoring](#)
-
- § Topics Covered:
 - § How are standardization work programmes and priorities evolving to bring industrial AM to scalability?
 - § What new materials, processes, and applications are emerging?
 - § What are the challenges?

Semi-annual Gaps Progress Reports

- § 21 Apr 2022 | [roadmap gaps progress report published](#)
- § Updates on recent work by the SDOs: Newly published standards, new standards projects

Recent Activities - Survey the Community

§ 2 Mar 2022 | Survey on use of the roadmap

§ 164 responses

§ Advisory Group determined revision to roadmap is warranted

§ Review priorities

§ Consider needs of various industry sectors in re: qualification/certification

§ Address variety of AM materials

§ Explore data management

Roadmap Overview

- § Identifies issues, as well as standards and specifications that exist or that are in development to address those issues

- § Identifies “gaps” & recommends development of new or revised standards, conformance and training programs, where needed
 - § A “gap” means no published standard, specification, etc. exists covering the issue in question

- § Suggests prioritized timeframes for standards development and organizations that may be able to perform the work

- § Captures any pre-standardization research & development needs

AMSC Topical Areas & Working Groups

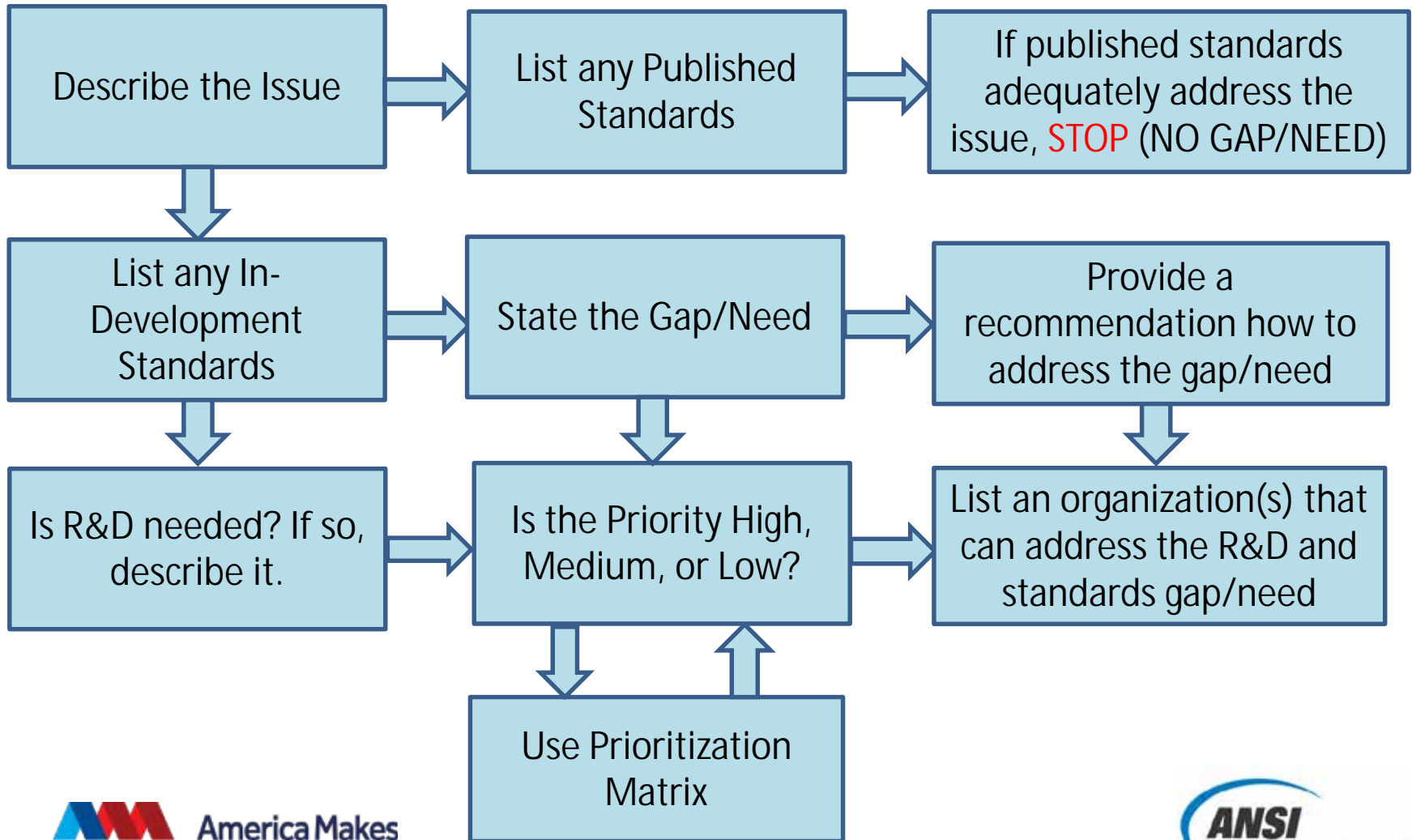
(“life cycle assessment of an AM part”)

- § Design
- § Process and Materials
 - § Precursor Materials
 - § Process Control
 - § Post-processing
 - § Finished Material Properties
- § Qualification & Certification
- § Nondestructive Evaluation
- § Maintenance and Repair
- § **Data (New for 2022)**
 - § Data Management and Integration
 - § Information Modeling
 - § Interoperability
 - § Data Visualization and Reporting

Working Groups

- § Engage subject matter experts to form subgroups and develop roadmap content
- § Typically hold twice-monthly online meetings (90 minutes) to review draft roadmap sections
 - § 2 co-chairs will be sought for each WG to preside over calls, help recruit volunteers to develop content, ensure work stays on schedule
- § Operate by consensus
- § More information on topics currently covered in the roadmap can be found in the [working group architecture](#)
- § Subject matter experts can [sign up for one or more working groups](#), indicate your sector, and interest in serving as co-chair

Process Flow for Describing Issues & Gaps/Needs



Sample Gap Statement (red fields are new)

- n **Gap DE1: Decision Support: Additive vs. Subtractive.** Currently there is no standard that helps users understand the advantages/disadvantages of AM processes versus traditional manufacturing processes while also providing decision criteria so informed design/manufacturing decisions can be made.
- n **R&D Needed:** Yes; No; Maybe
- n **R&D Expectations:** TBD (If R&D needed = Y or Maybe, please specify R&D needed or indicate TBD. If R&D needed = N, put N/A)
- n **Recommendation:** Develop a guideline that helps understand trade-offs between AM processes and traditional processes (e.g., sacrifice design freedom for greater certainty of established processes in terms of material properties, reliability, etc.).
- n **Priority:** High; Medium; Low
- n **Organization:** SAE, ISO, ASTM
- n **Lifecycle Area:** Design; Precursor Materials; Process Control; Post-processing; Finished Material Properties; Qualification & Certification; Nondestructive Evaluation; Maintenance and Repair; Data
- n **Sectors:** All/Sector Agnostic; Aerospace; Automotive; Construction; Defense; Electronics; Energy; Medical; Spaceflight; Other (specify) _____
- n **Material Type:** All/Material Agnostic; Metal; Polymer; Ceramic; Composite
- n **Process Category:** All/Process Agnostic; Binder Jetting; Directed Energy Deposition; Material Extrusion; Material Jetting; Powder Bed Fusion; Sheet Lamination; Vat Photopolymerization
- n **Q&C Category:** Materials; Processes/Procedures; Machines/Equipment; Parts/Devices; Personnel/Suppliers; Other (specify) _____
- n **Current Alternative:** what is being used while we're trying to fill the gap
- n **V3 Status of Progress:** Green; Yellow; Red; Not Started; Unknown; Withdrawn; Closed; New
- n **V3 Update:** To be filled in

Making the CASE for the Priority Level

Criteria

§ Criticality (Safety/Quality Implications) -

A high score means the project is more critical.

- How important is the project?
- How urgently is a standard or guidance needed?
- What would be the consequences if the project were not completed or undertaken?

§ Achievability (Time to Complete) - A

high score means there's a good probability of completing the project soon.

- Does it make sense to do this project now, especially when considered in relation to other projects?
- Is the project already underway or is it a new project?

Criticality Scoring Values

- § 3 - critical
- § 2 - somewhat critical
- § 1 - not critical

Achievability Scoring Values

- § 3 - project near completion
- § 2 - project underway
- § 1 - new project

Prioritization Matrix (contd.)

Criteria

§ **Scope (Investment of Resources)** - *A high score means the project can be completed without a significant additional investment of resources.*

- Will the project require a significant investment of time/work/money?
- Can it be completed with the information/tools/resources currently available?
- Is pre-standardization research required?

§ **Effect (Return on Investment)** - *A high score means there are significant gains for the industry by completing the project.*

- What impact will the completed project have on the industry?

Scope Scoring Values

- § 3 - low resource requirement
- § 2 - medium resource requirement
- § 1 - resource intensive

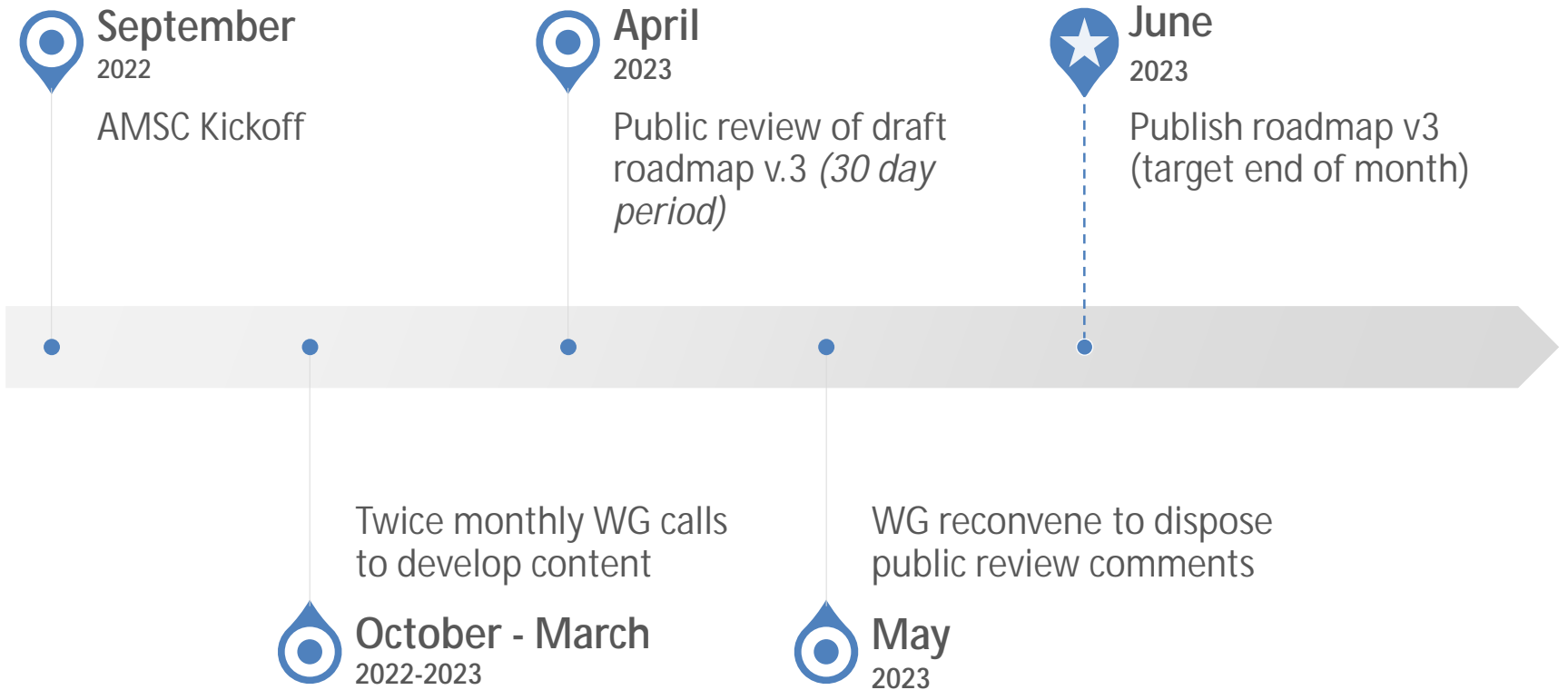
Effect Scoring Values

- § 3 - high return
- § 2 - medium return
- § 1 - low return

Priority Score rankings

- § High Priority (a score of 10-12)
- § Medium Priority (a score of 7-9)
- § Low Priority (a score of 4-6)

Project Timeline



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