ADDITIVE MANUFACTURING CENTER OF EXCELLENCE (AM COE)

ORGANIZATIONAL SPECIFICS

Standards Organizations:	ASTM International
Technical Committees:	F42 on Additive Manufacturing Technologies
Other Partnering Organizations:	Auburn University, EWI, MTC, NASA, NAMIC, NIAR, ISO, CEN, and many others
Government Organizations:	FDA, FAA, NIST, DoD
Industry Sector(s) / Technology:	Additive Manufacturing
Program / Activity Website URL(s):	https://amcoe.org/ & https://wohlersassociates.com/

STANDARDS DRIVEN PUBLIC-PRIVATE PARTNERSHIP (PPP) OBJECTIVES

PPP Drivers:

In July 2018, ASTM International and its founding partners Auburn University, EWI Buffalo Manufacturing Works, the Manufacturing Technology Center, and National Aeronautics and Space Administration (NASA) launched the Additive Manufacturing Center of Excellence (AM CoE). The AM CoE is a collaborative partnership representing industry, government, and academia to conduct strategic research and development (R&D) to advance AM standardization. The center also aims to accelerate development and adoption of AM by developing training and certification programs, and providing market intelligence, business strategy, and advisory services.

PPP Goals:

The mission of the Center is to bridge standards development with R&D to better enable efficient development of standards, education and training, certification, and proficiency testing programs. AM CoE works to advance AM through this improved approach to standardization by providing:

- **Strategic guidance and funding**: $15M+ combined support from partnership, government agencies, and industry
- **Coordinated R&D and expedited standards development**: 38+ projects initiated that are addressing 38+ standard gaps and impact existing standards (10 published standards, 13 balloting/approval, and 15 drafts under development)
- **Programs and services to support education and workforce development**: over 100 global team members, 22+ training courses, three certification programs developed

There are five strategic goals:

1. Close standards gaps and meet standards needs
2. Carry out AM research and development (R&D) to support all major industry sectors
3. Create strong global partnerships
4. Develop training, proficiency testing, and certification program
5. Host expert-oriented AM events, workshops, and conferences

There are five core activities

1. R&D: research needed to accelerate standards priorities
2. Training: world-class workforce development program
3. Certification: surveillance programs to audit the robust implementation of standards
4. Consortium: collaboration with industry to address needed R&D – focus on big data/AI
5. Market Intelligence/Advisory Services: provide intelligence and expert insight to support implementation/strategy development

Public Sector Role & Participation:

Founding and Strategic Partners: In late 2017, ASTM International began seeking key strategic partners to help launch the AM CoE. Through a request for proposals (RFP) process conducted in early 2018, four organizations were selected as

founding partners. All five founding partners have been playing complementary roles to support major pillars of the AM CoE.

In addition to the founding partners, identified and selected by the management team, a limited number of strategic partners bring specific material, industry sector, or regional expertise to the AM CoE. Two such partners were added in late 2018:

- National Additive Manufacturing Innovation Cluster (NAMIC) coordinates R&D and related activities for the Asia-Pacific region.
- National Institute of Aviation Research (NIAR) leads efforts to qualify additively-manufactured materials and to further strengthen relationships with key aerospace regulators worldwide.

Program Partners: The AM CoE also partners with organizations that can uniquely support one or more of its programs, such as R&D projects, workforce training, certificate programs, or other significant offering. These partners are also identified and selected by the management team.

Implementation Methods:

The AM CoE leadership includes representatives from each of its key stakeholder groups: government, industry, and academia. It is also structured to strategically support each of the CoE's core activities.

- **Advisory Board:** provides vision and direction of the AM CoE to ensure that it stays current with existing and future drivers of the industry
- **Steering Committee:** provides support and oversight to the AM CoE, including long-term and growth strategies
- **Management Team:** coordinates the day-to-day management of each function of the AM CoE and ensures alignment of activities with AM CoE objectives
- **R&D Team:** sets annual R&D priorities and projects, defines and manages the proposal process, identifies funding needs and potential funding opportunities, locates potential subcontractors as needed, and communicates and disseminates R&D results and/or new capabilities
- **Consortia Team:** brings industry together through consortia to capture investment to rapidly develop AM standards that address industry-identified needs

In the original period of the AM CoE program, which was set for five years, twice a year, the CoE opened Requests for Ideas (RFIs) and Calls for Projects (CFPs) to allow industrial, research, and academic organizations to propose research in specific areas that align with its mission of accelerating the adoption of additive manufacturing by addressing standardization gaps. After the initial period, the CoE shifted their funding strategy to leverage both industry and government. The AM CoE has completed many government grants and currently has ten active government funded projects.

Standards Activities: Both public and private stakeholders also participate in the ASTM F42 on Additive Manufacturing Technologies technical committee, subcommittees, and working groups, serving in a diverse collection of roles (including sponsorship, contractual agreements, strategy development, research, technical or content contributions, leadership, voting/abstaining, and monitoring/active participation). Global authorities and industry continue to directly participate in ASTM F42 to maintain and develop new standards. ISO & CEN continue to help maximize the global relevance of the standards deliverables by embracing a joint and (in many cases) a tri-adoption model, generating standards that carry ASTM, ISO, and EN designations. ASTM F42 is independent of the AM CoE and its operations also serve as another example of a public-private partnership.

ASTM technical (main) committees are divided into subcommittees which manage portfolios of standards on focused technical areas. Subcommittees form task groups (TGs) which work on individual drafts of standards. ASTM F42 has nine subcommittees (seven technical subcommittees and two administrative subcommittees), one of which is F42.90 Executive Subcommittee which is comprised of leadership from each subcommittees, as well as other representatives to give a balance of perspectives to the subcommittee. The executive subcommittee sets the strategic and technical direction of the committee.

Under F42.90 is a section referred to as F42.90.05 on Research & Innovation. This activity serves exclusively as an information conduit between the ASTM AM CoE and ASTM Committee F42. Its primary function is to provide feedback on standardization needs (either new standards, supporting work items under development, or updating existing standards), recurring R&D SOWs/proposals (focusing on specifically enumerated standards deliverables) under consideration by the AM CoE, including recommendation of an F42 subcommittee of jurisdiction, the possibility of any corollary program deliverables (training, PTP, certification, etc.), and any additional technical information they deem relevant to the proposals under consideration.

F42.90.05 does not develop standards and is closed to non-members. F42.90.05 meetings are held at least twice a year and face-to-face during biannual F42 meetings and as often as needed via teleconference. This section is typically chaired by an executive member of Committee F42. Proposals for F42.90.05 leadership may be submitted to ASTM staff and shall be considered by the AM CoE's Steering Committee and the AM CoE's Management Team.

Convening Experts: The AM CoE hosts several events such as webinars and workshops as well as an annual ASTM International Conference on Advanced Manufacturing (ICAM) which emphasizes standardization, qualification, and certification, with a particular focus on industry-specific requirements encompassing the entire advanced manufacturing processes and value chains.

Measurement of Success:

With input from government agencies, regulators, and subcommittee chairs within F42, the partners have identified, evaluated, and prioritized a critical set of topics that are forming the foundation of an R&D roadmap. The roadmap helps facilitate the development of high-value standards with quality characteristics that will ensure they are immediately beneficial to the AM community.

Since its inception in 2018, the AM CoE has launched over 35 R&D projects to accelerate AM standardization. Led by Center partners and research-to-standards (R2S) collaborators, these projects seek to generate technical data required for development of consensus-based standards by ASTM committees such as F42.

Key Takeaways:

1. **Incentivizing Participation:** Incentivizing involvement in research-to-standards programs is a crucial factor in accelerating standardization. Without proper incentives, participation and influence will remain limited, potentially slowing down progress.
2. **Defining Clear KPIs:** Establishing clear Key Performance Indicators (KPIs) from the outset is vital for the successful execution of these programs. Early definition of success criteria ensures that outcomes align with expectations and program objectives.
3. **Building an Ecosystem:** Creating a robust ecosystem around the program is essential to maximize engagement. The AM CoE program focuses on a variety of initiatives to foster and develop this ecosystem, ensuring broad participation and collaboration.
4. **Developing Skilled Talent:** One of the significant challenges was developing the right talent, particularly standard writers and technical experts, behind standardization drafts. While running a research-to-standardization project is manageable, success hinges on having the necessary skill set. The program placed a strong emphasis on cultivating talent to meet this need.
5. ASTM International was able to respond to industry needs very quickly. Bringing the relevant stakeholder population into the discussions during early stages of project development helped drive a rapid response and prepared stakeholders to maximize their productivity.
6. The implementation phase of activities is just as important as the development phases. To ensure this, especially with a collection of stakeholders relatively new to the development process, education and training (both early and ongoing) is critical.
7. Going to where the stakeholders are greatly improves the chances of their participation. For international acceptance, meetings (of both the COE & standards development arm via F42) should be held in a variety of

locations. Additionally, co-locating meetings with industry events where members already plan to attend can help increase participation (especially for task group meetings).

Advice for Others:

In this PPP, there was a significant reliance on active participation from industry, government, academia, and trade associations/professional societies (also a Partner Standards Development Organization (PSDO) agreement with ISO). While some participants have restrictions on the level of interaction they are permitted to undertake, this is often mitigated via proactive hosting of training/educational programs. The success of any standards activity is predicated upon the buy-in from and contributions by stakeholders – while funding can be a motivator, it is not a guarantee of success.

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