



2018 Additive Manufacturing Cluster Membership Packet



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Executive Summary:

The Northeast Ohio Additive Manufacturing Cluster is entering its second year of developing an innovation cluster that will establish the Midwest as the nexus of additive manufacturing (AM). The following pages describe the activities planned for 2018, which directly build upon the success of 2017. The remainder of the document details the outcomes of the cluster's activities in 2017.

An innovation cluster is essential for making a region globally competitive. The cluster helps commercialize new technologies, develop supply chain collaborations, launch new entrepreneurial ventures, and attract capital and research dollars. The success of the cluster depends on a diverse and active membership base. The cluster aims to provide value to cluster members through several activities and by offering opportunities for networking as well as access to industry experts.

2018 Key Activities:

The key activities build directly from the results of 2017 and will enhance the value the cluster provides to its members. The 2018 goals are intended to increase cluster membership, build an ongoing effort around AM for tooling, increase demand for design for production by teaching engineers design for 3D, gain a better connection to the demand side of AM to build out supply chain strengths in key market verticals, refine the cluster's business attraction strategy, and identify entrepreneurs and connect them to market demands.

- 1:** Launch a tooling supplier collaborative.
- 2:** Launch an Advanced Polymers working group.
- 3:** Fund and kickoff a regional DfAM training sessions through America Makes.
- 4:** Launch new AM related start-up companies by pairing them with orphan IP coming out of America Makes.
- 5:** Build supply chain strengths by having a stronger connection to the voice of the customer in the automotive, biomedical, and aerospace industries.
- 6:** Mentor manufacturers in uses for AM in tooling through the ATAP program.
- 7:** Engage manufacturers in the XJET printer and the opportunities it offers for ceramics printing.
- 8:** Promote cluster membership at national AM forums.
- 9:** Use cluster to help regional AM entrepreneurs grow faster.
- 10:** Grow attraction efforts to bring AM tech leaders to NEO.



2018 Events:

Cluster Meetings

Metal Sandcasting Technology

January 31, 9:00am-12:00pm

Location: HumTown Products, Leetonia

Advanced Materials for AM

June 6, 9am-5pm

Location: Cleveland, Corporate College East

R3D

September, co-promoted with Tri-C

Location: Cleveland

Cluster Promotion Events

Advanced Design and Manufacturing Show

<https://admcleveland.com/>

March, 7-8, Cleveland, OH

AM in Motion

<http://www.sae.org/events/ams/>

March 13-14, co-promoted with SAE

Location: Cleveland

RAPID

<http://www.rapid3devent.com/>

April, 24-26, Fort Worth, Texas

Ceramics Expo

<http://www.ceramicsexpousa.com/>

May, 1-3, Cleveland, OH

IX Center

America Makes Membership Exchange

November, 9:00am-5:00pm

Location: Youngstown



Additive Manufacturing Cluster Agreement

I BACKGROUND

The landscape of innovation is changing. In today's business environment, no word is more powerful than innovation. Every day, companies across the globe are introducing new technologies that have the potential to dramatically increase company revenues and change the industry. Internal, incremental change is no longer enough to maintain a competitive advantage. Today, open innovation networks are the mechanism for helping companies and industries to identify and connect with the technologies that match their product development needs.

Regional Innovation Clusters (RIC) are the demonstrated method for effectively connecting with open innovation networks. RICs are a geographic concentration of interconnected businesses, suppliers, service providers and associated institutions in a sector. RICs drive enhanced growth through the creation of high-value commercial platforms and world-class supply chains. They create prosperity, strengthen entrepreneurship and drive structural change.

YBI and Team NEO currently focus some of their organizational efforts on establishing an Additive Manufacturing RIC. The value proposition for Additive Manufacturing cluster members focuses on facilitating "Seeker – Solver" networks, in which innovation gaps are identified by major market segment leaders and matched with small/mid-size technology companies. The cluster also assists in building out competitive regional supply chains, assembling project teams, helping to identify and solicit funding, branding and marketing the cluster, generating "knowledge building" events and tools, conducting technology scouting, and delivering market research and analysis.

II AM CLUSTER MEMBER GENERAL SERVICES AND SUMMARY OF KEY BENEFITS TO COMPANIES

The members of the Additive Manufacturing cluster collaborate to create a supply chain of interconnected businesses and institutions to advance regional growth in AM. The scope of work includes developments in design for 3D, tooling, polymers, biomedical, aerospace, and creating an environment to grow start-ups and attract capital. To provide a coordinated collaborative environment for all stakeholders involved in the AM cluster, the following benefits are available to members:

- Connection to a highly-specialized supply chain of companies and institutions related to advanced capabilities and resources related to additive manufacturing
- Privileged relationships with world-class research institutions
- Business development and alliance support for strategic partnerships
- Participation in knowledge building events and communication forums
- Better leveraged capital through cluster sponsored programs
- Access to industry roadmaps and subject matter expertise
- Cost of Cluster membership and activities (cash and in-kind) can be applied towards the cost of an America Makes' membership (Restrictions may apply.)



IV FINANCIAL SUPPORT

- \$1,000 annual membership fee for for-profit companies
- Financial support for companies under 500 employees and start-ups are available to offset the cost of membership.
- Colleges, universities, and other educational institutions are exempt from financial obligation, but may be requested to provide in-kind services

VI CLUSTER ADMINISTRATOR - YBI

YBI is a 501(c)3 non-profit corporation organized and operated to help stimulate the economy of Northeast Ohio. YBI serves as the administrator of the Additive Manufacturing Cluster.

V TERMS OF AGREEMENT

An invoice based on the agreement signature date will be submitted to you with a copy of a jointly signed agreement. Membership terms are good for 12 months from the date of the invoice.

Name _____

Title _____

Company _____

Address _____

Signature _____

Date _____

Barb Ewing
CEO
YBI
24 West Federal Street
Youngstown, Ohio 44503

Signature _____

Date _____



2017 Outcomes:

Building on the 2016 *Asset Map of Additive Manufacturing Opportunities in Northeast Ohio* study, the **Northeast Ohio Additive Manufacturing Cluster** formally chartered itself in 2017. Five goals served as the foundation for building the cluster in year one. The cluster successfully attracted a solid base of industry participants, established name recognition for itself nationally, attracted several prospects to the region that will lead to future capital investments and job creation, and launched working groups that will help develop future supply chain collaborations. The work completed in 2017 created a solid foundation for the future of the Northeast Ohio Additive Manufacturing Cluster.

2017 Cluster Goals

Goal 1. Form a regional innovation cluster that relies heavily on focused engagement with America Makes and establishes Northeast Ohio as the nexus of AM in the Midwest.

Outcomes: Established the foundation of a cluster by attracting 65+ companies and institutions to cluster meetings and events. Rolled out a formal membership process which resulted in 37 signed membership agreements in year one. Convened industry leaders at three cluster meetings and two networking events and attended and promoted the cluster at 12 industry conferences.

Goal 2. Drive expanded applications of AM for tooling, fixtures, and enhanced manufacturing productivity by making investments in technical support, capital equipment, workforce development, and industry-based educational programs.

Outcomes: Launched the Advanced Tooling Acceleration Program (ATAP) that assisted 60+ companies in successfully integrating AM into their tooling processes. Chartered a tooling working group consisting of industry leaders to expand application for tooling.

Goal 3. Use formal education and workforce training initiatives to boost the adoption of AM and place a strong emphasis on the development and retention of design and engineering talent.

Outcomes: Chartered a Design for 3D Working Group to formalize efforts around teaching companies and engineers how to design in 3D for part production. Established a one-year operating plan that will be fulfilled in 2018.

Goal 4. Build out supply chain strengths in the key market verticals of the automotive, biomedical and aerospace industries, including an attraction strategy for key gaps in the existing supply chains.

Outcomes: Convened an Additive for Aerospace industry forum which attracted 110 attendees. Completed 13 attraction calls which led to the first XJET printer being installed in America, housed at the Youngstown Business Incubator, and a formalized partnership with the Junction.



Goal 5. Establish a framework that will foster entrepreneurship and commercialization of AM supply chain technologies, as well as the Northeast Ohio “maker” community.

Outcomes: Mentored 12 AM related start-ups who have been offered industry connections and access to supply chain collaborations. The start-ups experienced success by commercializing new technologies, expanding their businesses, hiring employees, investing in capital equipment, or attracting venture funding.

Goal 1:

Form a regional innovation cluster that relies heavily on focused engagement with America Makes and that establishes Northeast Ohio as the nexus of AM in the Midwest.

In 2017, the cluster convened three meetings to formalize the cluster, share industry knowledge and expertise, and to provide networking opportunities.

1Q Cluster Meeting - March 10

80 Attendees

50+ companies and institutions in attendance including Parker Hannifin, Lincoln Electric, NASA, and Rockwell.

The event was geared towards leaders in industry, education, workforce, government and economic development working in AM. The keynote speakers for the event were two attendees from the Trumpf Group, Dr. April Cooke, Additive Manufacturing Specialist, and Franziska Maschowski, Business Development Manager Additive Manufacturing. The German based, high-technology company offers production solutions in the machine tool, laser, and electronics sectors. They presented Trumpf’s latest technical innovations for 3D Printed Metals.

Attendees also heard from Rob Gorham, Director of Operations, from America Makes. Gorham talked about America Makes’ Technology Roadmap and its impact and opportunities for Northeast Ohio firms.

Additionally, there were breakout sessions led by industry experts to discuss key elements of the Northeast Ohio Additive Manufacturing Roadmap completed late last year. This reviewed the areas of focus for this cluster and how Northeast Ohio can strengthen its position on AM in the region. The purpose of this discussion is to identify project teams for pursuit of funding for these topics.

2Q Cluster Meeting - June 8

70 Attendees

50+ companies and institutions in attendance including Lubrizol, Strange Presse, Vorti-Siv, and Slice.



The event focused on tooling applications for additive manufacturing. Allen Kreemer, Sr. Manager of Application Engineering from Stratasys kicked off the meeting by giving an overview of the tooling applications for AM. Allen discussed how low-volume production tooling can create prototypes from the same process and materials that are used for the final product and bring new products to market even while waiting for the final tooling to arrive from the machine shop. Stratasys is the largest Original Equipment Manufacturer (OEM) for additive manufacturing in the world.

A panel followed the speaker which included discussions on new tooling processes and applications.

Five mini session presentations on AM for tooling were also presented.

3Q Cluster Meeting - October 11

60 Attendees

40+ companies and institutions in attendance including GE Additive, M Holland, and Park Ohio.

The event was focused on design for 3D with a keynote address from senior engineer Brock Wilt of SimuTech. The presentation regarded the topic of Topology Optimization.

Tony Hughes of the Lanterman Group presented on Design for 3D.

Three local companies and cluster members were offered an opportunity to present on their capabilities.

Cluster Networking Events

Networking is an important part of attracting membership to the cluster and to create opportunities for supply chain collaborations and technology advancements. In 2017, the cluster hosted two networking events.

Meet and Greet in Cleveland at MAGNET

January 25 – 64 Attendees

Meet and Greet in Lorain County

May 31 – 30 Attendees

Cluster Promotion

Creating Northeast Ohio as the Nexus of Additive Manufacturing involves significant promotion of cluster activities at local and national events. The cluster was promoted at the following events:

Advanced Design and Manufacturing Show, March 29 – 30, Cleveland

Benesch Law 3D Printing Annual Symposium, April 13, Cleveland

RAPID, May 9-10, Pittsburgh



- Portage Development Board Manufacturing Focus Group, May 23**
- NCDMM Summit, May 3-4, Pittsburgh**
- SME Smart Manufacturing Series, August 10, Cleveland**
- Start-Up ScaleUp, August 15, Cleveland**
- Tri-C 3D Printing and Additive Manufacturing Conference, September 22, Cleveland**
- Cleveland Engineering Society, September 29, Cleveland**
- 3D Printing for Jigs, Fixtures, and Molds, September 7, Cleveland**
- SSTI Annual Conference, September 13-15, Washington, DC**
- America Makes Membership Exchange, November 15-16, Cleveland**

Steering Committee

A steering committee is important for decision making and driving forward cluster activities and goals. The steering committee formed reflects an impressive list of diverse industry experts all committed to driving the adoption of AM in Northeast Ohio. In 2017, the steering provided valuable insight for driving forward the cluster goals.

Steering Committee Members

- Barb Ewing, CEO, YBI, Chairwoman
- Tim Fahey, Vice-President, Team NEO, Co-Chairman
- Melinda McNutt, Program Manager, Team NEO, Cluster Program Manager
- Brandon LaMoncha, Sales Manager, Humtown
- Rob Gorham, Executive Director, America Makes
- Mike Hripko, Associate Vice President for Research, Youngstown State University
- Mark Horner, Vice-President of Business Development, The Technology House
- Mark Avsec, Attorney, Partner & Vice-Chair, Benesch's Innovations and IP Practice Group
- Tony Hughes, President, The Lanterman Group
- Ethan Karp, President & CEO, MAGNET
- Vijay Iyer, Vice-President, BioEnterprise
- Darrell Wallace, President, Assimilogic
- Dr. Tracy Albers, President and CTO, rp+m
- Kirk Rogers, Technology Leader, GE
- Lisa Camp, Associate Dean, Strategic Initiatives, Case Western Reserve University
- Bob Pelletier, Engineering Manager, Parker Hannifin
- Alethea Ganaway, Program Manager Additive Manufacturing & Ideation Station, Tri-C
- Brad Whitehead, President, FFEF
- Tom Mathews, Vice-President-Research & Development, Lincoln Electric

Company Participation Roster

A diverse group of cluster members is what creates a robust collaboration platform

for industry participants, foster entrepreneurship, and aid in business attraction efforts.

Product Manufacturers / Users

Arconic
Catalysis 3D
Gasser Chair



Invacare
Iten Industries
Parker Hannifin
Schneller
Schaeffler
Slice
Timken
Park Ohio
Printing 3D Parts
Quality Electrodynamics
Swagelok
Unifrax
Vallourec
Venture Plastics

Materials Companies

Command Plastics
Fibre Tuff
Fila-Mint
Lubrizol
M Holland

Service Bureaus

Additive Engineering Solutions
Bravura 3D
Freshmade 3D
Humtown Products
IC3D
Pamton 3D Printing
rp+m

The Technology House

Machinery & Component Manufacturers

AST 2, Vista
3D Printer Work, LLC
Hapco Inc
JuggerBot 3D
Lincoln Electric
Maker Gear
StrangePresse
Vorti-Siv

Distribution

BDI
Fisher Unitech
Safran

Software

SimuTech

Consulting & Services

ASM International
Assimilogic
BioEnterprise
Benesch Law
Calfee Law
Defense & Energy Systems
HyQ Solutions
MAGNET

Metal Forming Magazine
M&P Gravity Works
NSL Analytical
ProMan Strategies
Ricoh
Sigma Labs
The Lanterman Group

Universities & Research Institutions

Case Western Reserve
University
Cuyahoga Community College
Lorain County Community
College
NASA
Ohio Aerospace Institute
Ohio University
University of Akron
Youngstown State University

Goal 2:

Drive expanded applications of AM for tooling, fixtures, and enhanced manufacturing productivity by making investments in technical support, capital equipment, workforce development, and industry-based educational programs.

Tooling Applications for AM Working Group Formally Chartered



The Asset Map identified tooling as the biggest short-term growth opportunity for the region. There is tremendous growth occurring in the use of AM for tooling, fixtures, jigs & molds. The working group will focus on accelerating use in the Northeast Ohio manufacturing community and work to identify and engage a much greater number of regional manufacturers.

Advanced Tooling Acceleration Program

The ATAP program teaches manufacturers how - and when - to use AM to develop tooling for low volume production. The State provides a subsidy to reduce printing and design costs. One case study revealed that creating a metal chute using AM resulted in a 65 percent reduction in cost; the next print will have a savings of 85 percent since the engineering costs have already been paid. The program is funded through the Ohio Development Services Agency. In 2017, 55+ companies were offered consulting on how to use AM for tooling.

Education around Tooling:

The Q1 and Q2 cluster meeting had a strong emphasis on tooling education. Cluster meetings offer an opportunity for cluster participants to learn from industry experts.

Goal 3:

Use formal education and workforce training initiatives to boost the adoption of AM and place a strong emphasis on the development and retention of design and engineering talent.

Design for 3D, Industry Education, and Workforce Development Working Group Formally Chartered

This group focuses on training companies on 3D design and creating a higher rate of adoption in utilizing Additive Manufacturing for Part Production. This working group aims to teach companies how to use AM by offering design and training from regional assets (America Makes, MAGNET, Youngstown State University, Tri-C, the ATAP Program, etc.).

Education around DfAM:

Each cluster meeting had a strong emphasis on Dfam education, specifically the presentations given by Trumpf at the Q1 meeting and AddUp at the Q2 cluster meeting. Cluster meetings offer an opportunity for cluster participants to learn from industry experts.

Goal 4:

Build out supply chain strength in the key market verticals of the automotive, biomedical and aerospace industries, including an attraction strategy for key gaps in the existing supply chains.

The aerospace industry is key market vertical for developing supply chain strengths. The cluster partnered with the Ohio Aerospace Institute to host an Additive for Aerospace Industry Forum.



The goal of the Additive Manufacturing for Aerospace Event was to showcase success stories and compelling reasons for implementing additive manufacturing from tooling to final parts. The presenters and panel sessions provided the details of how they overcame the hurdles for AM produced parts while also explaining how second and third tier suppliers can become AM part fabricators.

July 13 - 110 total attendees

70+ companies and institutions in attendance. ASM International, NASA, Polymer Ohio, and Arcelor Mittal. Keynote presentations from GE Aviation, and University of Dayton Research Center.

Current supply chain gaps are an opportunity for a strategic business attraction strategy to increase foreign direct investment. Target companies include OEM's, software companies, and opportunities to attract materials and R&D centers. The cluster team facilitated several attraction visits in 2017.

Business Attraction Strategy

A business attraction strategy is an important part of building out a competitive supply chain. In 2017, cluster leadership met with several companies to recruit them to expand their business to Northeast Ohio.

XJET Partnership - XJet has selected the Youngstown Business Incubator, and its partner, Youngstown State University, as its first USA customer for the XJet Carmel 1400 additive manufacturing (AM) system. Poised to transform the metal and ceramic additive manufacturing industries, the XJet Carmel AM system features the company's patented NanoParticle Jetting technology that enables the production of metal or ceramic parts with the ease and versatility of inkjet printing without compromising throughput or quality. The partnership will focus on ceramic materials for both research and development and part production. Ceramics have strong applications for AM products in the aerospace and biomedical industries.

Israel Soft Landing Program - YBI is now part of The Junction, an Israel-based business accelerator. Israelis are leading the world in so many areas in terms of technology, both on the software side and the additive manufacturing side. The Junction represents an acclaimed program that is among an elite group of entrepreneurs. Other partners in the Junction are tech giants Hewlett-Packard and SAP.

Goal 5:

Establish a framework that will foster entrepreneurship and commercialization of AM supply chain technologies, as well as the Northeast Ohio "maker" community.

By establishing a cluster framework that is co-led with the Youngstown Business Incubator, synergies are created that allow entrepreneurs and start-ups the opportunity to thrive and flourish. Access to networking, technical expertise, and personal introductions to potential customers are all benefits of



participating in the innovation cluster. The following are a list of AM-related start-ups who are members of the cluster and are personally mentored by cluster leader, Tim Fahey.

YBI Portfolio Companies

3D PrinterWorks	Hot End Works
Additive Engineering Solutions	JuggerBot 3D
Bravura 3D	Pamton 3D
Fila-Mint	Printing 3D Parts
Freshmade 3D	StrangePresse
Gemini Industrial Machines	Vista / AST 2

Portfolio Company Success Stories

Freshmade 3D announced their new material, AMClad and tested the durability using a 3D Printed bowling ball.

Strangpress has been awarded exclusive global licenses for a polymer deposition nozzle and exhaust valve assembly developed by the Oak Ridge National Laboratory.

JuggerBot 3D received an AMP Grant to partner with Mercy Health, Fibre Tuff Biopolymers, Whiteside Prosthetics and Orthotics, and Valtronic to maximize 3D printing in the Orthotics and Prosthetics space using an advanced biopolymer.