

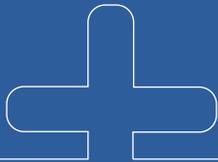
# WE MAKE THINGS HERE

IDEAS + PRODUCTS + PROFITS

NEO DRIVER INDUSTRIES accounted for 62% OF AM SYSTEM WORLDWIDE SALES\*  
\*IN 2014



## ADDITIVE MANUFACTURING



## WE HELP

# MANUFACTURERS INNOVATE WITH ADDITIVE TECHNOLOGIES

Northeast Ohio (NEO) is uniquely positioned to help businesses adopt and leverage additive manufacturing (AM) technologies. Our historically strong manufacturing base and workforce, broad range of university and institutional resources, and connections to end-user markets already using 3D printing technology (the biomedical and aerospace markets, for example), put us at the center of AM innovation. We are building a thriving AM cluster that is setting the course for the future of manufacturing.

### SUPPLY CHAIN STRENGTH

Northeast Ohio's robust value chain offers great opportunity for companies seeking AM technology and partners. A study conducted by the collaboration of the Youngstown Business Incubator, MAGNET (Manufacturing Advocacy & Growth Network), Team NEO and America Makes identified 165 distinct companies and organizations directly involved in the AM supply chain. This number continues to grow as established and emerging partnerships accelerate the adoption and advancement of AM in the region.

### END USERS

Two industries core to Northeast Ohio – biomedical and aerospace – represent the leading end-user markets for direct part production via AM. NEO is home to aerospace AM leaders such as Parker Hannifin and Arconic; regional adoption of AM for medical devices and implants continues to grow in companies like SLICE, OsteoSymbionics, and QED.

In addition, AM is now experiencing rapid adoption for use in tooling, molds, jigs and fixtures – an industry at the heart of the Ohio economy. This has opened up the opportunity for manufacturers to produce components cost effectively at much lower production volumes than previously possible. This has significant implications for increasing innovation through lower fixed capital costs and shorter design iteration cycles. It is estimated that the opportunity for AM tooling production in Ohio will reach \$1 billion by 2020.

### SUCCESS TELLS THE STORY – LEADING AM COMPANIES IN NEO

Many leading manufacturers in Northeast Ohio have adopted AM technologies to positively impact their bottom line. Here are just a few examples:

**The Technology House (TTH)** has been providing AM design, prototyping and manufacturing services for

many years, using SLA and FDM processes. In 2015, TTH was selected as a beta site for the new Carbon M1 printer. Currently, TTH is one of only a handful of service bureaus in the world with the ability to print production parts with Carbon's CLIP technology, an exciting new process offering a wide array of engineering grade materials, faster build speeds than conventional AM technologies and more consistent mechanical properties. TTH now has multiple Carbon machines in production, standing at the forefront of the next wave of AM usage for larger-scale production.

**Rapid Prototype and Manufacturing LLC (rp+m)** is recognized throughout the industry as one of the lead technology providers in AM, offering research and development services, concept design optimization and rapid manufacturing of both polymer and metal AM parts. The rp+m team has extensive experience with polymers, metals and ceramics, helping clients solve technical challenges, from designing parts for 3D to developing new materials. Using DMLS, binder jet, FDM and PolyJet, rp+m provides manufacturing solutions to all major markets for 3D printed parts.

**Parker Hannifin**, the world leader in fluid and motion control, has located a corporate center for additive manufacturing at its technology incubator in Macedonia, Ohio. Parker, a major industrial leader in Ohio, has deployed additive manufacturing in multiple applications.

**Cleveland Clinic's Lerner Research Institute** uses AM technology to create highly accurate 3D models that surgeons can use as visual aids to prepare for each individual's unique anatomy. Multicolor Objet printers are used to create models of body parts from patient scans, with applications such as visualizing the vascularization in a patient kidney or the reproduction of a patient's vascular system to help model fluid flow for research purposes.

**Additive Engineering Solutions (AES)** is the world's first BAAM service bureau. Using technology developed at Oak Ridge National Labs, Akron-based AES enables 3D printing of large area tooling and production parts. AES also provides the first open-source opportunity for aerospace, defense, energy and automotive manufacturers to procure low-cost, large-scale AM tooling.

#### **RESOURCES COMMITTED TO THE ADVANCEMENT OF ADDITIVE MANUFACTURING**

Home to America Makes, the national accelerator for AM and 3D printing, Northeast Ohio provides specialized support through a variety of resources. For example, a formalized AM Regional Innovation Cluster (RIC) focuses on facilitating "seeker-solver" networks that connect small to mid-size technology companies with established anchor institutions for their mutual benefit, with the ultimate goal of building AM strength throughout the region.

These Northeast Ohio organizations are among those supporting the growth of AM:

- **America Makes** provides a linking network of public and private entities committed to advancing the technology and industry for AM.
- **Youngstown Business Incubator** develops programs to support the adoption of AM technology in the existing industrial and defense supply chains, and supports entrepreneurs working in the field.
- **Team NEO**, a regional economic development organization, along with our partners, focuses on creating jobs and helping businesses thrive in Northeast Ohio.
- **MAGNET**, the Manufacturing Advocacy & Growth Network, is a nonprofit organization dedicated to helping manufacturers compete and grow, including helping them better understand AM methods and how they can be practically applied.

#### **IN ADDITION:**

- **ATAP, the Advanced Tooling Acceleration Program**, funded by the Ohio Third Frontier, helps manufacturers integrate emerging advancements in additive and digital manufacturing, with the goal of accelerating the growth of direct digital manufacturing (DDM) and AM technologies for tooling.
- **P3N**, the Precision Printed Parts Network, educates business owners in the metal casting industry on the value of AM and how to incorporate it into their businesses.
- **Sandcore** champions 3D printing technology adoption in the metal casting industry.

#### **EDUCATION AND RESEARCH**

Northeast Ohio's higher education institutions are committed to preparing students for AM technology careers. Among the 26 accredited colleges and universities in our region (with nearly 400 more within a 150-mile radius), are these leaders committed to AM education:

**Case Western Reserve University (CWRU)** actively engages in additive manufacturing research, bringing strengths of faculty working with both metals and polymers to the design of new materials as well as modeling and simulating new additive processes. Using the Think[box] innovation and entrepreneurial facility, users are able to engage with a wide range of additive equipment, from table top to industrial scale models. Start-up companies ranging from consumer electronic products to aerospace applications access this equipment and showcase results at national competition (SxSW) and national shows (Consumer Electronics).

**University of Akron (UA)** has a rich history and critical mass of research and development in polymers enabling the College of Polymer Science and Polymer Engineering to advance AM technologies. New chemistries and media compositions, modeling and visualization of process and product, as well as unique interfacial characterization techniques, non-destructive analysis and design expertise for multiple platforms are being applied to AM challenges. Akron Polymer Technology Services (APTS) offers AM workforce development training as well.

**Cleveland State University (CSU)** is offering students a unique educational environment designed to further their interest in the applications of additive manufacturing. CSU's Center for Innovative Manufacturing, a premier AM facility, is focused on satisfying the growing technological and engineering needs of the Northeast Ohio region.

**Youngstown State University (YSU)** has created the Center for Innovation in Additive Manufacturing (CIAM) to advance research, education, workforce development and industry partnerships in this emerging field. An exciting hub of AM activities, CIAM provides a resource for the College of STEM as well as other academic divisions, including arts and health sciences.

**Cuyahoga Community College (Tri-C)** offers a 3D Digital Design & Manufacturing Technology Certificate program to train individuals for positions in this growing field.

**Stark State College** offers students skilled AM training in the high-tech environment of its 3D Center.

Manufacturers seeking **AM technologies** choose Cleveland Plus. From ideas to products to profits, we make things here. We make things happen.

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**Team NEO**  
1111 Superior Avenue, Suite 1600  
Cleveland, OH 44114  
Phone 888.NEO.1411  
**clevelandplus.com**

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