



**Division of  
Science, Technology  
& Innovation**

# **AM Ecosystem In New York State**

**Christopher J. Rooney-Business Development Additive Manufacturing**

**A Division of Empire State Development**

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# AM Vision

- \*Help SMM's modernize and compete using current additive manufacturing (AM) technology and further expand AM ecosystem**
- \*Support development of next generation manufacturing technologies NYS**
- \*Encourage development of superior products including creation and incubation of new applications for AM and attendant 1<sup>st</sup> to market advantages**
- \*Transfer examples of approaches where AM has already been shown to impart value e.g.**
  - light weighting parts**
  - create specialty tooling/fixtures**
  - make small production runs**
  - mass customizations**
  - production on demand**
  - superior prototyping**

# America Makes

**\*America Makes is the nation's leading and collaborative partner in AM technology research, discovery, creation, and innovation. Structured as a public-private partnership, America Makes innovate and accelerate AM to increase our nation's global manufacturing competitiveness**

**\*Manufacturing USA network of member institutes-catalyzing the development of new technologies, educational competencies, production processes, and products via shared contributions from the public and private sectors and academia**

# NYSTAR Role

- \*NYSTAR administration of NY MEP represents an opportunity for ESD-funded centers to assist in promoting AM's benefits to existing companies and assisting them and entrepreneurs with adoption**
- \*NYSTAR entire network of funded centers e.g. university-based research centers and test sites present a key network through which AM education, outreach and tech adoption projects can be pursued**
- \*AM outreach to travel the state speaking to industry and entrepreneur groups and referring companies to research and innovation resources that can assist them adopting AM**



# NYSTAR Technology Partners

- \*RIT Additive Manufacturing and Multifunctional Printing (AMPrint) Center Rochester NY
- \*Center for Automation Technologies and Systems at Rensselaer Polytechnic Institute Troy NY
- \*Center for Advanced Materials Processing at Clarkson University Potsdam NY
- \*Center for Advanced Ceramic Technology at Alfred University Alfred NY
- \*Additive Manufacturing Laboratory at Binghamton University Binghamton NY
- \*Hudson Valley Advanced Manufacturing Center at SUNY New Paltz
- \*EWI Buffalo Manufacturing Works Buffalo NY
- \*Additive Manufacturing Materials, Prototyping and Applications Center at SUNY Stony Brook
- \*Advanced Institute for Manufacturing at Mohawk Valley Community College Utica NY

**ASSETS ACROSS THE BREADTH OF NEW YORK STATE SUPPORTING AM EXPANSION**



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# RIT AMPrint Center

**\*Rochester NY-Among 1<sup>st</sup> research centers in the world to focus specifically on multifunctional 3D printed parts that require electrical, thermal, optical, magnetic, biological or chemical functionality- NYS Center for Advanced Technology (CAT)**

**\*RIT researchers are:**

- synthesizing new functional materials that are optimized for 3DP**
- developing multi-material 3DP techniques that can print polymeric, metallic, and even ceramic materials within the same part**
- developing novel applications that take advantage of these new multi-functional 3DP capabilities**

**\*Equipment:**

- Markforged MetalX FDM metal printer, MarkOne 3D capability composite parts w reinforced carbon, fiberglass or Kevlar fiber**
- Vader Systems Magneto-Jet prints liquid aluminum alloy droplets**
- ExOne M-Lab binder jet printer that produces metal or ceramic parts**
- EOS P380 SLS machine for polymer**
- Stratasys systems for thermoplastics applications**

**\*Multifunctional 3D Printing Symposium 6/12-6/14/19 Rochester NY**



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# Rensselaer Polytechnic Institute

## CATS

**\*Troy NY-Center for Automation Technologies and Systems is directly linked or affiliated with 3 Manufacturing USA hubs (smart manufacturing, robotics, biopharma), a teaching factory (Manufacturing Innovation Learning Lab) and a supply chain management center located at RPI-NYS CAT**

**\*CATS facilities comprise 12,000ft2 of lab/office space at George Low Center for Industrial Innovation:**

- Advanced robotics and industrial automation**
- Additive and bio additive manufacturing**
- Composites and bio composites manufacturing**
- Metals and ceramics processing**
- Micro/nanomanufacturing**
- Smart Manufacturing**



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# Clarkson University CAMP

**\*Potsdam NY-Center for Advanced Materials Processing mission is to form alliances with industry, corporations, and government entities in NYS to assist in applying science, engineering and technology development-NYS CAT**

**\*Materials Processing:**

**-Additive manufacturing using metals and alloys**

**-Film deposition methods for metals, alloys and dielectrics**

**-Anti corrosion**

**-Chemical mechanical polishing substrates beyond Si**

**\*Materials characterization: full spectrum of analytical tools**



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# Alfred University CACT

**\*Alfred NY-Center for Advanced Ceramics Technology at Alfred is home to some of world's foremost experts in ceramic engineering, materials and glass science, and applied industrial research**

- Ceramics processing facility and pilot plant-NYS CAT**
- Computer modeling labs**
- Thermal analysis lab**
- Powder characterization laboratory**
- Thin-film processing facilities**
- Mechanical testing**
- Surface Microstructural Analysis**



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# Binghamton University AML

\*Binghamton NY-Additive Manufacturing Lab at Binghamton includes 4 different 3D printers that produce testing and piloting parts in a variety of thermoplastics and metals-NYS CAT

\*Equipment:

-MakerBot replicator 2x: creative part production with 2 interlaced colors that can be printed through precisely aligned dual nozzles without swapping or pausing

-Stratasys uPrint SE Plus: FDM technology to build functional models and prototypes in ABS thermoplastic

-Objet 30Pro: polyjet technology offering eight different 3D print materials among them clear, high temp PP-high print resolution, smooth surface, thin wall

-EOS M290: build volume 250x250x325mm M290 allows for fast, flexible and cost effective production of metal parts from CAD data



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# SUNY New Paltz HVAMC

**\*New Paltz NY-Hudson Valley Advanced Manufacturing Center “Build Business Platform” provides guidance to businesses leveraging 3DP from prototyping to end use-NYS CAT**

**\*Collaboration of academic, industry, and private practitioners dedicated to providing application support, design education, and 3DP technology accessibility to regional businesses**

**\*Equipment: New Lab 2019**

**-2 Stratasys Dimension 1200ES FDM printers**

**-30 MakerBot Replicator 2 and 2x desktop**

**-3D Systems PROJET 660 full range color jetting**

**-Stratasys Fortus MC**



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# Stony Brook University AMMPAC

**\*Stony Brook NY-The Additive Manufacturing Materials Prototyping and Applications Center leverages leading expertise and state-of-the art analytical and manufacturing equipment at SBU and at the Composites Prototyping center to support education, training, adoption and optimization of AM technologies-NYS CAT**

**\*Prototyping facilities include FDM thermoplastic polymer and composite printing, UV Photopolymerization printing**

**\*Advanced functional materials R&D including polymer nanocomposite blending and extrusion equipment, systems for spark plasma sintering and ball milling, wet chemistry and electrochemical synthesis**

# EWI Buffalo Manufacturing Works

- \*Buffalo NY-EWI an industry leader in AM by evaluating new processes, developing material property data, and innovating advancements for in-process quality monitoring and non-destructive inspection of complex 3D structures**
- \*Metal 3D print process capabilities include laser and EB powder bed fusion, laser and arc directed energy deposition, binder jetting, and access to ultrasonic AM through affiliate Fabrisonic**
- \*\$35M facility Summer 2019 Northland Redevelopment Corridor project-test site**

# MVCC AIM

**\*Utica NY-Mohawk Valley Community College has established a program designed to assist SMM companies in to make individual systems run more efficiently, increase profit margin, develop new innovative products, and create and retain manufacturing jobs**

**\*Advanced Institute for Manufacturing has been designated as a Manufacturing Extension Partnership (MEP) Center that provides manufacturing and tech development programs and training services to a six-county region in upstate Mohawk Valley**

**\*AIM services small manufacturing start ups, assisting with innovation strategies, supply chain management and technology commercialization**

**\*FABLab equipment:**

**-Stratasys uPrint FDM printer, various Makerbot Replicator desktop thermoplastic printers-test site**



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# SUNY Clinton Community College

- \*Institute for advanced Manufacturing is a 30,000 ft<sup>2</sup> state-of-the-art facility designed to serve as a regional hub for manufacturing education
- \*North Country Regional Economic Council focus aerospace/transportation/manufacturing as priority cluster for economic development
- \*Feeder program Norsk Titanium, Bombardier, Nova Bus/Volvo, SpencerARL, Mold-Rite Plastics
- \*Test site

# Tech Valley COG

- \*Troy NY-Tech Valley Center of Gravity is a maker space/creative community/prototyping center and manufacturing business incubator**
- \*Focus on creative collisions-STEAM programming**
- \*AM innovation-Stratasys F270 FDM printer access provided Center for Economic Growth, a regional NY MEP**
- \*The Manufacturing Incubator at TVCOG focused on risk mitigation for start ups and provides coaching, expertise, prioritized actions and needs based referrals to support inventor/innovator community**
- \*Test site**



# Company Highlights-NYS AM

- \*Norsk Titanium
- \*Incodema 3D
- \*Xerox/Vader Systems
- \*PostProcess Technologies
- \*Harbec
- \*Evolve Solutions
- \*GE Global Research
- \*Lithoz America
- \*ChemCubed
- \*nTopolgy
- \*BotFactory
- \*NYC/LI



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# Norsk Titanium

- \*Plattsburgh NY-Norsk Rapid Plasma Deposition process FAA-certified, OEM qualified AM process that produces structural titanium parts with reduced lead time, material waste and lower cost structures v. traditional forging**
- \*RPD can produce near net shape parts weighing up to 100 lbs at rates 50-100x faster than powder-based AM systems**
- \*Consume 25-75% less titanium than existing forging processes**
- \*Boeing/Spirit AeroSystems/defense/commercial**
- \*Expansion production space 2019**

# Incodema 3D

**\*Freeville NY-Incodema 3D a leader in direct metal 3DP and specializing in direct metal design and production applications**

**\*Direct Metal Laser Sintering AM technology-60000ft2 manufacturing facility expanding 2019**

**\*Aerospace/medical/energy sectors**

**\*Specialties include:**

**-On staff AM experts**

**-Complex designs and geometries**

**-Part consolidation**

**-Redux of development time and part weight**

**-High accuracy output to specs**

**-strong and durable components-produce meta components 99.8% dense**



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# Xerox/Vader Systems

**\*Buffalo NY-Vader Systems provides 3D metal print solutions that enable their partners to build metal parts 100x faster than existing market solutions with safer material handling and less waste**

**\*RIT AMPrint**

**\*Magnet-O-Jet technology utilizes control and precision of an electromagnetic field to propel liquefied metals to produce high integrity parts faster**

**\*Xerox acquisition 2/19**

# PostProcess Technologies

**\*Buffalo NY- PostProcess proprietary software, patent-pending hardware and eco friendly chemistry work together to remove the bottleneck in the third step of AM, post printing-make process of removing supports and surface finishing printed parts easier, more consistent and more efficient**

**\*Post processing solutions across industries including aerospace/defense/automotive/consumer/dental/medical**

**\*Designed for all 3DP print materials and 3D print technologies**

# Harbec

\*Ontario NY-40 years of innovation-40000ft2 manufacturing facility-no carbon footprint efforts

\*HARBEC is an AS9100 and ISO13485 certified and ITAR registered contract manufacturer of tight tolerance precision 3D printed metals and plastics, machined components and assemblies, and injection molded components and assemblies

\*Aerospace/medical/diversified industrial applications

\*Metal AM Equipment:

EOS M290 DMLS Machine 250x250x325mm build volume

EOS M270 DMLS Machine 250x250x325 build volume

# Evolve Additive Solutions

**\*Brighton NY-R&D-bringing Selective Thermoplastic Electrophotographic Process (STEP) to market**

**\*New company to drive Stratasys incubated innovation aimed at high-volume production using a wide range of thermoplastics at speeds comparable to conventional manufacturing processes**

**\*STEP technology delivers the well-known advantages of additive manufacturing with cost-per-part and surface quality in line with traditional manufacturing, along with X, Y, Z directional strength and mechanical properties rivalling injection molding**

**\*\$19M equity funding with LEGO Brand Group and Stanley Black & Decker 2018**

# GE Global Research

\*Niskayuna NY-Additive Design and Producibility

**GE Vision:** Advancing the state-of-the-art in AM to dramatically simplify and shorten steps needed to design and build complex metal parts

**Mission:** To enable customers to innovate through AM utilizing GE Research systems, controls, materials, design and fabrication expertise

**Team:** GE Research Additive team consists of scientists with mechanical, electrics, optical, controls, materials, physics, and software capabilities-team works closely with materials characterization, non-destructive testing, computational fluid dynamics, AI, and trusted computing capabilities at GEGR

**Facilities:** Niskayuna NY

-25000 ft2 of dedicated lab space

-Laser, Electron Beam, and Binder Jet powder bed commercial and experimental systems

-Powder handling and cleaning systems

-Post process equipment including heat treatment, sintering and full-service machining

-In house and commercial software for AM design, build processing and simulation

-High performance computing



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# Lithoz America

- \*East Greenbush NY- subsidiary of Lithoz GmbH and responsible for growing AM markets in US and Canada**
- \*Lithoz America offers collaboration in research projects and consulting services along the entire value chain of the AM of high-performance ceramics through Lithography-based ceramic Manufacturing (LCM)**
- \*Applications range from bioresorbable bone replacements to high performance casting cores**

# ChemCubed

**\*Stony Brook NY-ChemCubed focuses on end-use applications for physical, mechanical, conductive and insulative properties for the final output requirements of UV curable and non-UV curable nano composite liquids suitable for SLA (stereolithography), syringe extrusion and piezo inkjet (jettable) technology printers.**

**\*Capabilities allow ChemCubed to develop custom jet nanocomposite formulations that are application specific, meet customer requirements in physical/electrical/thermal/chemical properties**

**\*A collaborative effort of technical and marketing professionals with over 20 years experience in the printing industry, ChemCubed launched its research laboratory at Stony Brook University. Associated with the Advanced Energy Center, the institution is world renowned for its cutting-edge strength in materials research**

**\*Successful applications include 3D print optics/inkjet print electronics/functional structural materials**

# nTopology

- \*New York NY-nTopology has developed a combination of generative, manual and simulation-based design tools**
- \*Element software package can optimize lattice structures based on user-defined inputs, imported data, or their integrated finite element analysis**
- \*Users can customize lattice topologies/create stochastic structures/implement structural ribs/build conformal structures/optimize parts**

# BotFactory

- \*New York NY-BotFactory line of PCB printers brings electronic circuit fabrication to the desktop-prototype a fully assembled and functional circuit board in minutes vs. weeks**
- \*PCB printers include inkjet heads that can dispense conductive and insulating inks allowing build of multilayered rigid or flex circuits on FR-4, Kapton, or any other substrate**
- \*Each printer has 2 heads for dispensing glues and solder pastes, another to pick and place components supporting full PCB assembly all in one desktop unit**

# NYC/LI

- \*Graphene 3D Lab-graphene enhanced functional thermoplastic materials for 3DP-Ronkonkoma NY
- \*Voodoo Manufacturing-3DP prototyping and design service bureau-Brooklyn NY
- \*Shapeways-3DP marketplace and service-users design and upload 3DP files and Shapeways prints-New York NY
- \*R3 Printing LLC-3DP equipment manufacturer-Long island City NY
- \*AI Space Factory-architecture and technology company-3DP structures for Mars space exploration-New York NY
- \*Boyce Technologies-utilize 3DP in manufacture of public safety kiosks-Long island City NY

# FuzeHub

- \*Are you a NYS manufacturer in need of assistance?
- \*Contact FuzeHub, a non-profit partner of NYSTAR, for a free consultation and referral to the right resource
- \*Manufacturing grant applications open 5/1/19
- \*Innovation Fund
- \*[www.fuzehub.com/expert-consultation/](http://www.fuzehub.com/expert-consultation/)
- \*[info@fuzehub.com](mailto:info@fuzehub.com)

# Thank You!

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