



A Catalyst for Economic Growth in Maryland: RAMP MD's P3

Five Key Takeaways

1. Regional Additive Manufacturing Partnership of Maryland established by the General Assembly to expand the additive manufacturing industry by leveraging taxpayer-funded additive manufacturing assets at APG
2. Industry poised for enormous growth and Maryland is at leading edge because of concentration of resources and expertise in the state
3. RAMP MD viewed as model public-private partnership by other installations, other states, even other countries
4. Tangible benefits to both government and industry
5. RAMP MD builds partnerships with industry, expands additive manufacturing education, conducts awareness and outreach, and ensures a supportive infrastructure

RAMP MD's Origin and Purpose

- Maryland's General Assembly chartered RAMP MD in May 2014. Senator J.B. Jennings and Delegate Mary-Dulaney James co-sponsored the legislation (SB889/HB1060), which was signed into law by Governor O'Malley, establishing Maryland as the nation's center of excellence for additive manufacturing, and RAMP MD as the catalyst for industry growth. RAMP MD is funded by grants from Maryland Department of Commerce and event sponsorships. The Board is all volunteer.
- The objective is to stimulate economic growth of new and existing businesses with attendant creation of middle- and high-income additive manufacturing jobs in the northeastern region of Maryland. The partnership's foundation is the leveraging of the U.S. Army's multi-million-dollar investment in additive manufacturing equipment and 30 years of experience found at Edgewood Chemical Biological Center and the Army Research Laboratory for the benefit of broader economic growth.

Growing the Additive Manufacturing Industry and the Industrial Base

- The field of additive manufacturing is poised for enormous growth and has the ability to transform manufacturing as we know it. Nationally, the additive manufacturing market has grown from \$1B in 2012, to \$8.8B in 2017, and is expected to grow to \$26.5B by 2021.
- Additive manufacturing represents an enormous growth opportunity for Maryland because of the critical mass of capability that is already located within the state – including defense, aerospace, bio-medical, and other sectors. In particular, the geographic co-location of the biotechnology and additive manufacturing industries positions Maryland to be on the leading edge of advancements in medical device design prosthetics, wearable technology, and tissue engineering.



- In turn, because of this growth, APG organizations enjoy an expanded industrial base in additive manufacturing, which strengthens the Army's support to the warfighter.

Benefits to Industry

- RAMP MD holds an overarching Cooperative Research and Development Agreement (CRADA) with RDECOM under which Joint Work Statements are developed for each business partner. These businesses range from medical device developers to guitar manufacturers to car wash technologists.
- The Joint Work Statements can be executed in weeks instead of the months required for a CRADA and because the process is streamlined, very small businesses can participate. This is important because this is where most job growth occurs. Additionally, small businesses can access resources within the federal government typically beyond their reach, on a rapid turnaround and low-cost basis.
- More than 20 business partners have signed joint work statements and they come from all corners of the state.

Benefits to Government

- The partnership benefits the Army and APG in that it exposes government personnel to new applications of additive manufacturing and private sector best practices, and keeps skills and equipment fine-tuned between mission-related projects. These partnerships also help offset the cost of operating and refreshing equipment that must be ready to serve the warfighter.
- In many cases, joint work statement partnerships have resulted in contracting opportunities for local companies to develop new products for the Army and technology transfer initiatives.
- Through its partnership with RAMP MD, APG has had the opportunity to meet other federal, state, and local governments, in some cases resulting in new partnerships between agencies. Most recently, partnerships were developed with Alcohol, Tobacco and Firearms and the University of Maryland Systems.
- The partnership helps the Army build, develop, and recruit a workforce with advanced skills in additive manufacturing. It also provides workload to fill and level demands on a non-interference basis, while exposing the government workforce to industry drivers and practices related to additive manufacturing.

RAMP MD's Next Steps

- Education: RAMP MD works to expand workforce by working with colleges and school systems to integrate additive manufacturing coursework. This is resulting in educational partnerships among secondary and college institutions and new degree programs. This year, we plan to work with APG and the state of Maryland to help develop an apprenticeship program that supports the additive manufacturing industry.
- Outreach: RAMP MD has hosted three Symposia featuring the nation's leading voices in additive manufacturing: "Additive Manufacturing – More Than 3D Printing" in May 2015,



“New Frontiers of Bio-Medical Additive Manufacturing” in March 2016, and “3D Aerospace & Defense” in January 2017. Our next Symposium is April 11, 2018, called “Maryland’s 3D Medical Revolution,” which will explore how additive is transforming medical and dental care in Maryland. These Symposia have attracted hundreds of speakers and attendees from a very broad geographic area and from a broad range of industries.

- Partnerships: We will continue to seek out new JWS holders from across Mid-Atlantic to come to Maryland and work with manufacturers to adopt additive manufacturing technologies. Additionally, we will look for new partnership and contractual vehicles for industry to use and work to further streamline transactions between partners.
- Support Infrastructure: This year RAMP MD is building a web-based additive manufacturing community of practice and working the Department of Commerce to conduct a survey of manufacturers on their use and applications of additive manufacturing technology.

RAMP MD 2017-2018 Board Members

- Mary Bolt, Cecil College
- Rob Carter, Army Research Lab (advisory, non-voting)*
- Chris Cosgrove, SURVICE Engineering
- Neil Davis, TEDCO
- John Desmone, Towson University
- Bruce England, Susquehanna Workforce
- Mike Galliazzo, Regional Manufacturing Institute
- Mary Hastler, Harford County Public Library
- Rob Limpert, Harford County Public Schools
- Art Marriott, Orbital ATK
- John Mayhorne, Harford Community College
- Harry McArthur, Terumo Medical
- Jill McClune, Avon Protection
- Morgan Miller, Cecil County Public Library
- Mary Morris, University of Maryland System
- Chris Moyer, Cecil County Office of Economic Development
- Karen Holt, Harford County Office of Economic Development
- Mike Parker, Northeastern Maryland Technology Council
- Nicole Parr, Cecil County Public Schools
- Todd Sabin, MD Department of Commerce
- Mark Schlein, Edgewood Chemical Biological Center (advisory, non-voting)
- Kris Shock, MD Department of Commerce
- Dave Wheatley, DWE Inc.
- Sean Wise, Repliform

Staff

- Rick Decker, Executive Director
- Joan Michel, Program Manager

**Rob Carter left RAMP MD in November when he left ARL and took a job in another state. We are in process of replacing him with another advisory/non-voting member from ARL.*

RAMP MD STRATEGY FOR EXPANDING THE ADDITIVE MANUFACTURING ECOSYSTEM

| VISION | | |
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| RAMP-MD is the catalyst for establishing Maryland as the nation’s epi-center for additive manufacturing with a highly-skilled workforce and supportive business/innovation infrastructure. | | |
| MISSION | | |
| RAMP MD facilitates advanced manufacturing economic growth, partnerships, and benefits for entrepreneurs, inventors, government, educators, and investors, creating new jobs in Maryland. | | |
| GOALS | | |
| Goal 1: Build awareness of additive manufacturing | <i>Initiatives</i> | <i>Future Activities (Expanded Resources)</i> |
| | Raise visibility of northern Maryland as major hub of additive manufacturing capability. | <ul style="list-style-type: none"> Establish regular (quarterly) dialogue with legislators, key industry partners, and government officials from across the state. Promote Maryland’s additive manufacturing resources nationally Expand outreach to officials in Pennsylvania, New Jersey, Delaware, and Virginia. |
| | Increase awareness of additive manufacturing for the purpose of expanding its adoption in traditional businesses and increasing partnerships with RAMP MD. | <ul style="list-style-type: none"> Host four Symposia per year focused on different sectors and applications (medical, aerospace, defense, automotive) Continue conducting tours of ECBC and ARL facilities for stakeholders and potential JWS holders Establish regular communications vehicles with stakeholders where we highlight unique applications of additive manufacturing Work with existing manufacturers to adopt AM within their product development process |
| Goal 2: Construct educational and training pathways to additive manufacturing careers | <i>Initiatives</i> | <i>Future Activities (Expanded Resources)</i> |
| | Facilitate dialogue between educational institutions and the additive manufacturing industry focused on constructing pathways for students to prepare for fields in AM and expand resources available to schools. | <ul style="list-style-type: none"> Host additive manufacturing educational and training pathway “summit” meeting for the purpose of identifying existing K-20 programs Develop and publish roadmaps to additive manufacturing careers so students see the pathways into this industry Build formal apprenticeship program approved by Department of Labor and including participation from K-12 and community colleges. Also work with veteran organizations to develop pathways to opportunity in this field Link JWS partners with schools for mentorship, internships Work with middle schools to incorporate additive manufacturing resources/equipment and curriculum into technology courses |
| | Raise awareness among educators of breadth of AM career opportunities and resources. | <ul style="list-style-type: none"> Develop and electronically publish guide to additive manufacturing careers Include educator “track” at conferences |

RAMP MD STRATEGY FOR EXPANDING THE ADDITIVE MANUFACTURING ECOSYSTEM

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| | | <ul style="list-style-type: none"> • Coach educators in incorporating 3D printing into existing lessons/projects |
| <p>Goal 3: Expand financial and technical resources to support industry growth</p> | <p><i>Initiatives</i></p> | <p><i>Future Activities (Expanded Resources)</i></p> |
| | <p>Collaborate with subject matter experts and proponents of advanced manufacturing, and build alliances that advance our core mission and vision</p> | <ul style="list-style-type: none"> • Support development of an on-site incubator for start-up AM companies • Support ARL’s Open Campus initiative • Participate in development of Innovation Hub and include additive manufacturing as transformative technology • Clarify key sectors to work within that align with regional assets, interests, resources and talents • Establish web-based community of practice for networking and sharing of best practices among additive manufacturing professionals |
| | <p>Procure funding to sustain RAMP MD as an advanced manufacturing innovation authority for the mid-Atlantic</p> | <ul style="list-style-type: none"> • Identify funding opportunities outside of MD DoC • Build alliances to pursue funding as a coalition of like-minded AM advocates |
| <p>Goal 4: Build Partnerships with Businesses</p> | <p><i>Initiatives</i></p> | <p><i>Future Activities (Expanded Resources)</i></p> |
| | <p>Expand number of businesses entering into partnership with APG organizations and expand utilization of JWS agreements</p> <p>Increase opportunities for businesses to work with federal laboratories</p> | <ul style="list-style-type: none"> • Proactively recruit additional businesses from mid-Atlantic region to enter into JWS partnerships with RAMP MD and APG organizations • Expand partnerships to include additional federal additive manufacturing resources • Add contractual vehicle (OTA) to RAMP MD’s service offerings to businesses • Develop direct connections to technology transfer opportunities in federal labs and match with business community in additive manufacturing |