The Commonwealth Center for Advanced Manufacturing

CCAM

SOLVING ADVANCED MANUFACTURING CHALLENGES

Prince George, VA

Gaps in the Digital Thread Across the Multiple Tiers of Manufacturing Supply Chains: An R&D Perspective

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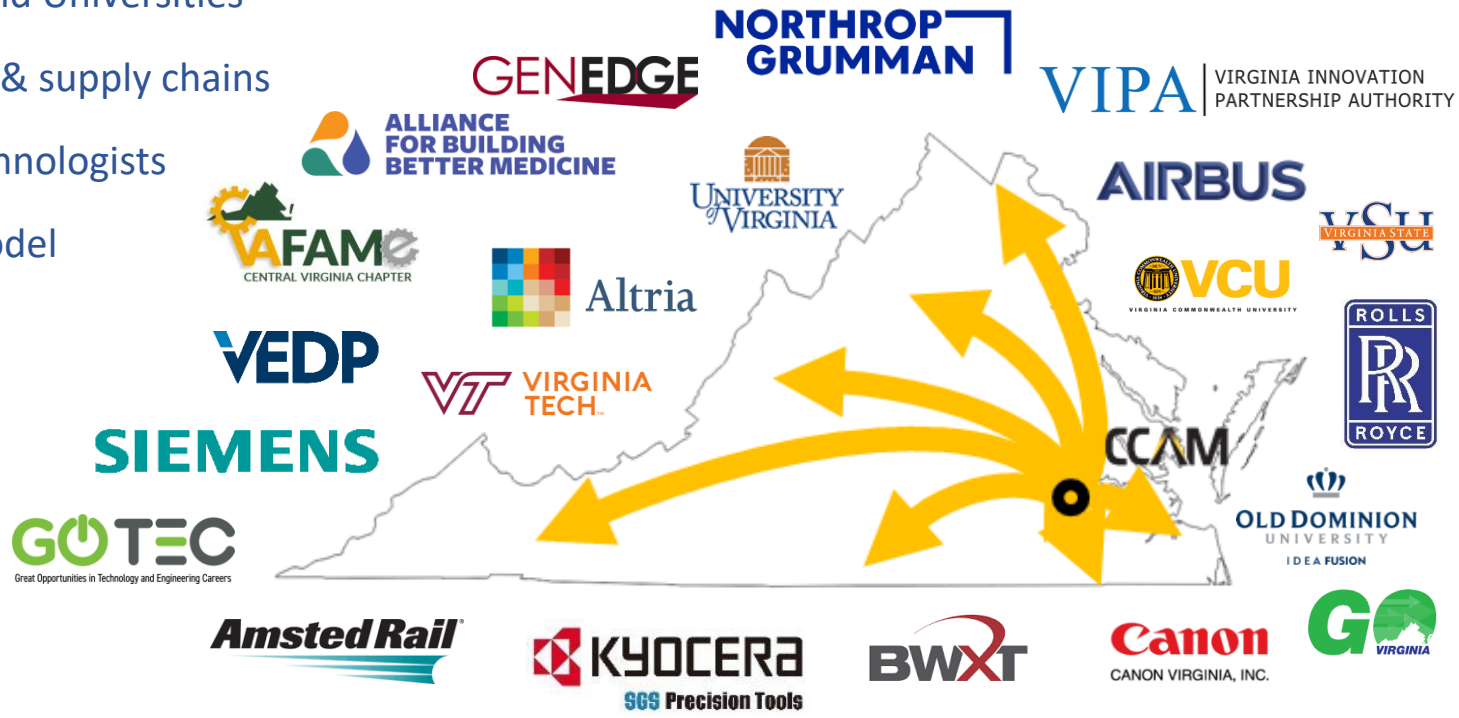
CCAM – Who we are…

A Virginia-Centered Global Community Focused on Solving Real Manufacturing Challenges

- **Led from** a dedicated research facility in south central Virginia
- **Collaborating** across Industries, Government, and Universities
- **Global network of companies** across industries & supply chains
- **World class team** of scientists, engineers, & technologists
- Unique **sponsor-driven** Intellectual Property model
- **Leading research universities** in Virginia
- 501(c)3 **Non-profit** institute

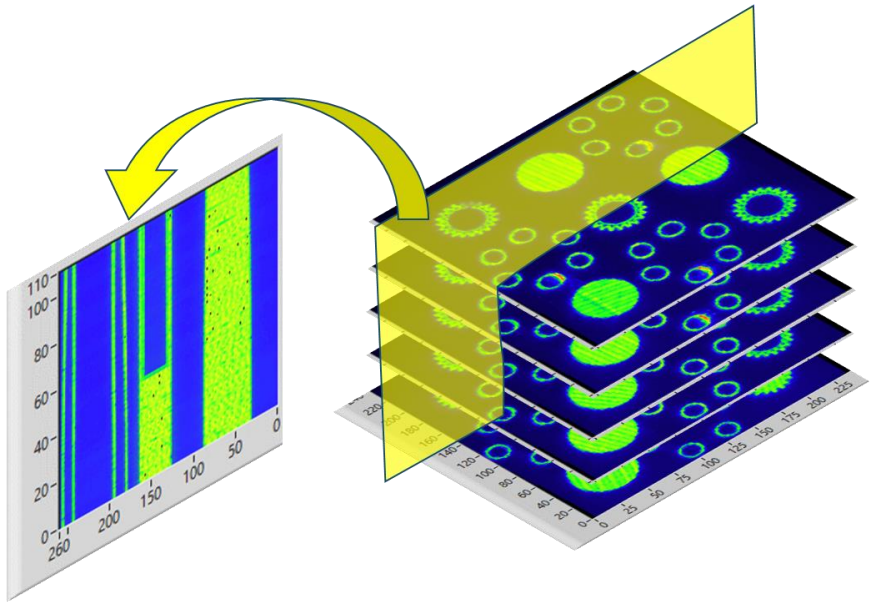
Transforming Manufacturing *Together!©*



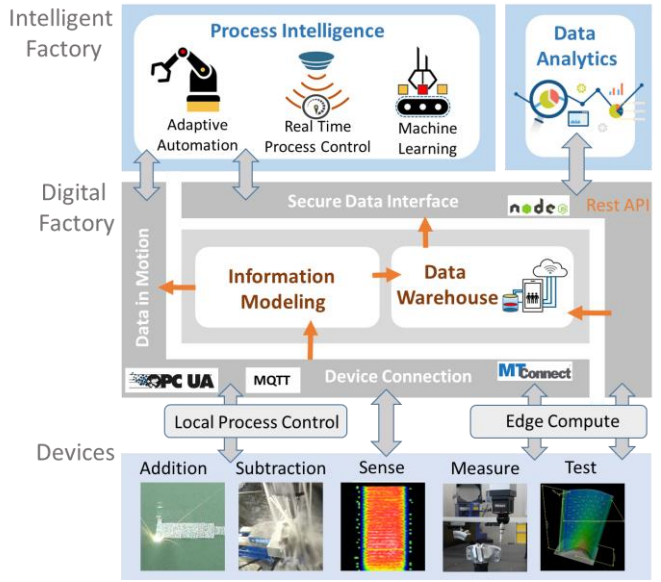
Key CCAM Focus: Digital Manufacturing

CCAM provides **synergy** of digital systems expertise, process intelligence tools and advanced manufacturing processes and materials

Industrial Scale Equipment



Process Intelligence:
In-Situ Sensing, Process Models, Planning Tools



Digital Systems:
Digital Architectures to **Enable Real Time Use** of Intelligence Data in Industrial Settings

Example: Dynamic Manufacturing Processes (such as Additive Manufacturing, Thermal Spray)

CCAM
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Manufacturing USA Technology Roadmap (MfgTech) Grant Program

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

OAGi Open Applications Group

SecureAmerica Institute

VSU Virginia State

BR&L Consulting

GENEDGE

VCU Virginia Commonwealth University

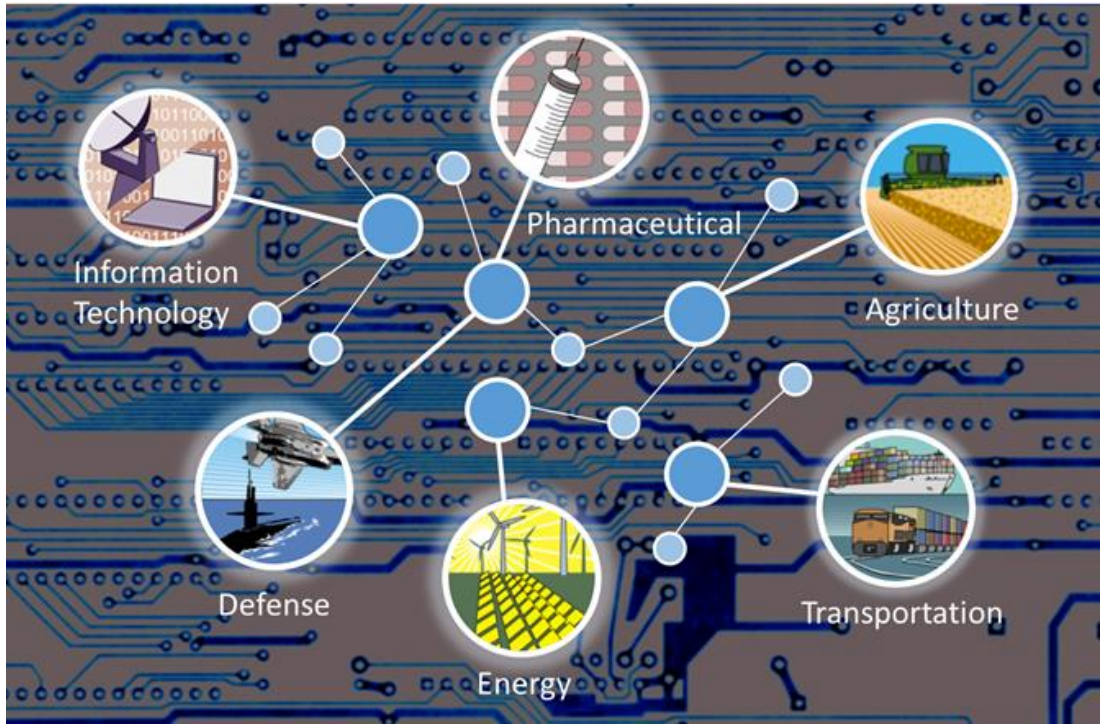
MTConnect®

Overarching Goal

Digital thread technologies could transform the ability of manufacturers to:

A) increase throughput and efficiently meet standards for quality and conformance **(capacity)**

B) Provide unprecedented visibility to their supply chain networks and the ability to quickly respond to potential disruptions and quality issues **(resilience).**



Goal: develop a technology roadmap to improve the resilience and capacity of the US manufacturing supply chain through the digital thread.

Anticipated Challenges to Adoption of "Digital Thread" to Aid Supply Chain

- Recognizing disruptions in the supply chain – be they internal or external disruptions – takes too long
- Manufacturers struggle to meet cost and schedule objectives while simultaneously satisfying quality and regulatory requirements
- Insufficient collaboration between public and private stakeholders
- Accessing and associating product lifecycle data across supply chain boundaries is too hard
- Organizational and geographical data silos create barriers to digital thread realization
- Lack of clear vision about what systems to connect and how
- Standards landscape is murky
- Lack of trust between organizations both internally and externally
- Duplicated Efforts and multiple sources of truth – Data often is copied from system to system

Aerospace & Defense Question Group: Barriers to Adoption of "Digital Thread"

- The group identified several key barriers towards broader adoption of "Digital Thread" concepts including:
  - **Intellectual Property:** Because of the proprietary nature of the industry, sharing key manufacturing data beyond what is within Technical Data Packages is difficult if not impossible
  - **System Interoperability:** Major enterprise software system provides (e.g., ERP, MOS, PLM) are not designed to interoperate with other systems without significant effort (and cost)
  - **Benefits:** Lack of defined, measurable benefits at all levels of the supply chain, especially related to the integration with small and mid-sized manufacturers
  - **Commitment:** Commitment from company senior management to enable capabilities or invest in solutions
  - **Standards:** Lack of standards for application (whether industry standards, international standards, national standards, or system/solution standards)
  - **Real-Time Data:** Lack of consistent, real-time or near real-time supplier and production data from different systems
  - **Skillset:** Need and investment for advanced training and support for additional data/system requirements
  - **Data Management:** One respondent mentioned the "cost of curation" needed to maintain the digital library and manage the quality of the information being shared

A&D Question Group: Future Benefits for “Digital Thread” in Aerospace and Defense

- The overall desired end-state for “digital thread” focused on potential benefits including:
  - Standardized, exchangeable data across different systems
  - Ability to retain and recall production data to perform causality assessments for part failure
  - Reduced costs to manufacture and improved time from order to delivery
  - Scalable systems that can handle rapid increases in demand in response to emerging needs
  - Flexibility in supply chain sourcing through open data standards
- Other benefits desired by the group included:
  - Hybrid manufacturing with human workforce enabled by autonomous manufacturing.
  - Improved efficiencies through real-time data analysis, possibly with integration of AI tools

Intelligent AM Ecosystem for Component Repair and Replacement

Identify Impactful AM Repair Use Case

IAM Ecosystem can be repetitively leveraged for additional parts, processes, users, & applications

Transfer
Deploy a qualified process to a different site, cell, or system

Translation
Adapt a process to a different material, feature, or design

Expansion
Ingest new technology to expand to new sites, part families, etc.