Advanced Technology & Training Center (ATTC) & Additive Manufacturing

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Overview

- Mission -- Advance Technology & Training Centers (ATTCs)
- ATTCs Overview
- Academic Collaboration
- Training
- Additive Manufacturing within the Air Force
- Team Approach

Advanced Technology & Training Centers

The primary mission of the Advanced Technology and Training Center in Middle Georgia (ATTC-MG) is to qualify state-of-the-art advanced technologies for the sustainment enterprise while providing training for engineers and operators through a collaborative environment.

Advanced Technology & Training Centers

- Advanced Technology Training Centers are located in
  - Dayton, OH (ATTC-Dayton) and
  - Warner Robins, GA (ATTC-MG)
  - Pittsburg, PA (TITAN/ATTC)

- ATTC reports directly to Air Force Life Cycle Management Center, Product Support Engineering Division (AFLCMC/EZP), Wright-Patterson AFB

- Tasked to identify, assess, develop, validate, verify and deploy new technologies for implementation across the sustainment enterprise to:
  - Improve readiness
    - Supporting out of production spares, low-volume builds, tooling/fixtures/jigs, etc., for sustainment ops and training
  - Reduce sustainment costs

Advanced Technology & Training Centers

- The ATTC-MG is equipped to deliver and/or support the following to AF platforms:
  - Design optimization for new technology implementation (Additive Manufacturing (AM), Cold Spray, etc.)
  - 3D Scanning and Modeling
  - Metal and Polymer AM: EOS, Stratasys - Fortus
  - Cold Spray restoration
  - Post-processing operations: machining, heat treatment
  - Advanced Coatings: Non-chrome E-Coat, Powder Coat
  - Condition-Based Maintenance plus (CBM+)

Advanced Technology & Training Centers

- ATTC-MG operates out of a 44,000 square-foot (approx.) contracted facility space
  - Equipment within the facility is Government-owned
  - Product/Services does not cost the System Program Office (SPO)

- Located less than 5 miles from Robins AFB, GA
  - Enabling the right equipment and opportunities for collaboration between academia, industry, research, and Air Force engineers and maintainers

- ATTCs focuses on four main areas to deliver better capabilities faster and cheaper:
  - New technology application
  - Experimentation
  - Process development
  - Training

Advanced Technology & Training Centers

- Share best practices and lessons learned
  - AM Design Rule Book

- Provide education and awareness of polymer and metals AM, scanning and modeling, AM materials, design for AM, and lessons learned for AM
  - Developmental Guidance Notifications
    - 19-001: AM DRB
    - 19-002: AM Strategic Implementation Plan (AMSIP)
    - 19-003: AM Request Form and Parts Tracker
    - 19-004: AM Equipment Purchase
    - 19-005: Process for Printing Qualified AM Parts
    - 19-006: ATTC Processes, Categories, Inspection and testing

Advanced Technology & Training Centers

- ATTC-MG is a key player in laying the foundation for additive manufacturing across the Air Force – detailed in the United States Air Force AMSIP that includes the following principles:
  - Standardized processes and equipment
  - Certified operators and machines
  - Skilled technicians and engineers
  - Cyber secure, centralized technical data
  - Enterprise network

Academic Collaboration

- University of Georgia
  - Utilizing additive manufacturing for heat exchanger optimization
  - Materials research across additive manufacturing & cold spray
- Georgia Institute of Technology (GT) (on the horizon)
  - facilitate training and use of campus lab equipment via ATTC-MG employees
  - creating of working space at GT for an ATTC-MG employee
  - Supporting Jr-level research, Sr design projects, & graduate school research/special topics
- Mercer University
  - Senior Projects: Hand Prosthesis with Jointed Fingers & Offroad Car Uprights
- University of Alabama
  - Strain controlled fatigue and crack growth rate testing (17-4 SS and Ti-6-4)
- Central Georgia Technical College
  - Laying foundation for AM and Cold Spray training and development
- Georgia Southern University
  - Support/Judging Sr. design projects
  - Laying groundwork in coordinating on testing of AM materials

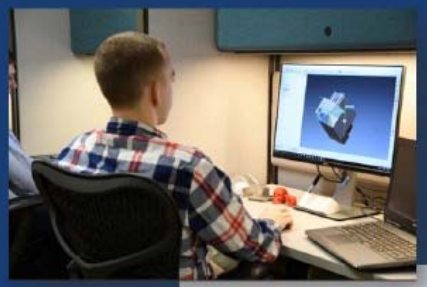
On-Site Training/Courses

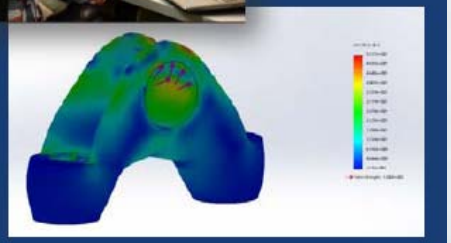
Technicians

- EOS M290 On-line Operator
- EOS M290 In-residence Operator
- Fortus 450/900 On-line Operator
- Fortus 450/900 In-residence Operator

Engineers

- Fundamentals of AM Design (Polymers)
- Fundamentals of AM Design (Metals)
- Advanced AM Design (Polymers)
- Advanced AM Design (Metals)



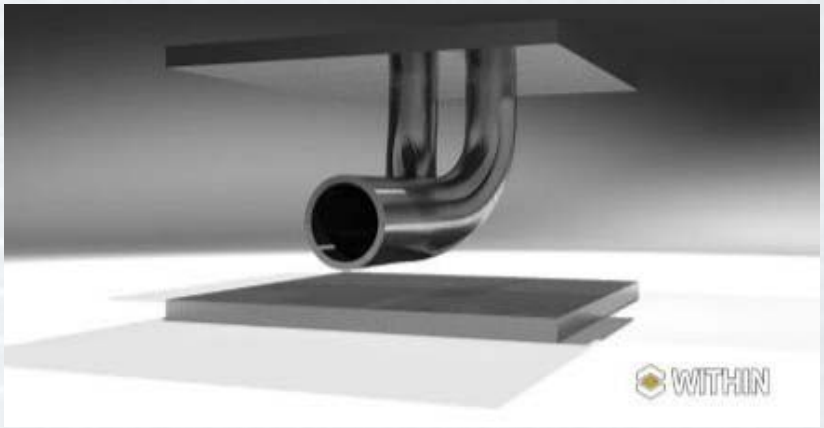


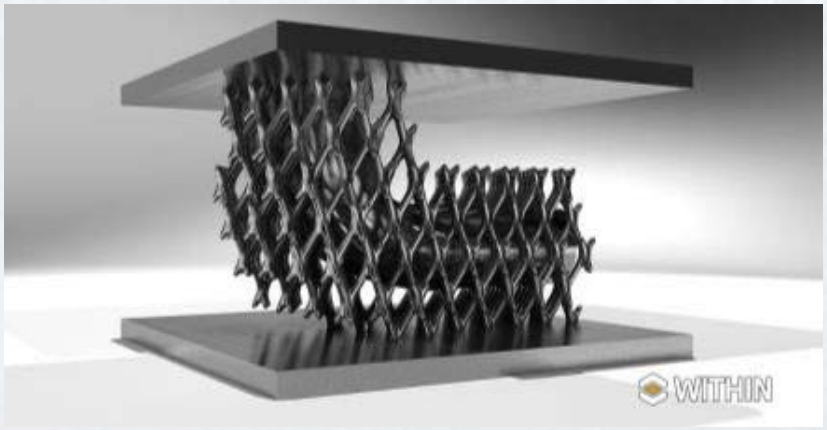
On-Site Training/Courses

Course name	Duration	Software
Funds of AM (to include some basic design content)	2 day	Z-suite
3D CAD modeling & GD&T with SolidWorks	2-3 day	SolidWorks
FEA with Inspire	2 day	Inspire
Advanced Design for AM (Polymers)	2.5 day	Insight/control center
Advanced Design for AM (Metals)	2.5 day	SolidWorks, Magics, RP tools, EOS print
Scanning & Modeling	2-3 day (almost done with development)	DesignX, VXElements, FARO, Handyscan

Design for AM

From block to advanced 3D-printing solution





AM Across the Air Force

NOW TERM: Stable Foundation of AM Metals and Polymers Capabilities

- Establish selective AM capability: depots & MAJCOM backshops
- Qualify target parts: diminishing manufacturing, non-critical structural aircraft parts
- Standard AM equipment, training, processes, and tools
- Scanning & modeling process & tools
- Develop facility guidelines and post processing

NEAR TERM: Expanding AM Capability in Metals and Polymers

- Expand AM capability: additional weapon system components, expanding across depots, MAJCOMs, and program office engineering
- Qualify target parts: critical structural aircraft components
- Demonstrate network capability and cyber secure library
- Validate AM process controls, material characterization, process parameters, and reproducibility

LONG TERM: Establish Manufacturing Repair Network

- Target opportunities: print anywhere on-demand
- Target parts: rotating aero hardware
- Global network of equipment and processes

AM Across the Air Force

Today

Mainly Polymer Based

- Printing polymer training aids, fixtures, & low criticality parts
- Materials data for stainless steel, titanium, & Ultem™
- Metal & polymer components currently flying on 5 airframes
- Advanced Technology & Training Centers (ATTC)
- Educating leaders, engineers & technicians

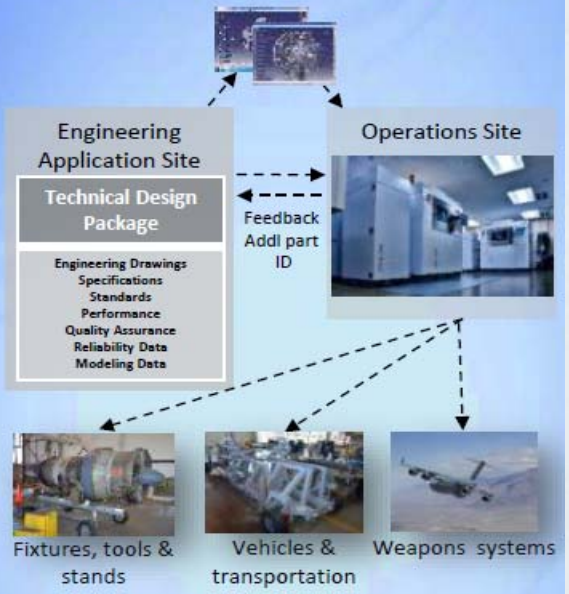
Tomorrow

Centralized Applications

- Qualify higher criticality parts
- Expand materials database to high strength/temp alloys
- Standard AF documentation
- Qualified operators/machines
- Implement digital thread/twin
- Expand ATTCs
- Implement initial qualified field level capability

Future

Agile Manufacturing



- Global manufacturing network using digital thread
- Cyber secure parts library
- Print on demand, any time, any machine

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Advanced Technology & Training Centers

Co-located with centers of engineering experience

AM Across the Air Force

As of April 2019

> 74+ polymer printers

> 18+ metals printers

> 36+ locations with printers

- Air Force Bases:
  Tinker, Hill, Robins, Randolph AFBs
- AFSC REACT, AFRL, AFIT,ATTCs

EOS SLS

Markforged composite

3DS Zcorp

Concept Laser

Stratasys Objet

3DS ProX SLA

AM Across the Air Force

ATTC – Dayton Metal (DMLM)

> EOS M100 (1)

> EOS M290 (11)

Polymer (FDM)

> Fortus 450mc (1)

> Fortus 900mc (3)

ATTC – Middle Georgia Metal (DMLM)

> EOS M100 (1)

> EOS M290 (4)

Polymer (FDM)

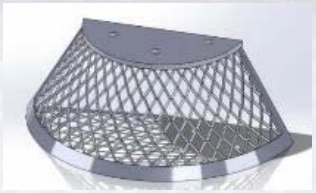
> Fortus 450mc (1)

> Fortus F900 (2)

AM Across the Air Force

Casting Tooling

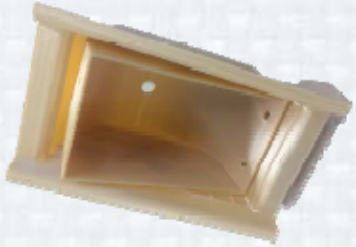
Wheel Chocks



C-17 Anti-collision Light Guard

C-5 Latrine Cover

C-5 Service Door Hinge



C-17 Utility Panel Housing Flashing

Smart Bomb Rack T, Y, and 4 to 1 Connectors

Avionics Cooling Ducts

F-100 HPT Case Install/Lift Fixture

F-15 C/D Contactor Cover

C-5 Stair Ladder Fitting

Team Approach

Leveraging pockets of excellence to champion the enterprise approach


AIR FORCE LCMC