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WICHITA STATE UNIVERSITY

Additive Manufacturing at WSU-NIAR

Brandon Saathoff & Neville Tay

IM3

INDUSTRIAL MODERNIZATION
OF MATERIALS & MANUFACTURING

Introductions

IM3 Speakers

Brandon Saathoff
Senior Engineering Manager,
Advanced Materials Research

Neville Tay
Research Engineer, Advanced
Materials Lab

NIAR IM3

Industrial Modernization of Materials & Manufacturing

- Qualification & Certification
- Data Management
- Applications
- Consulting
- Education & Workforce Development

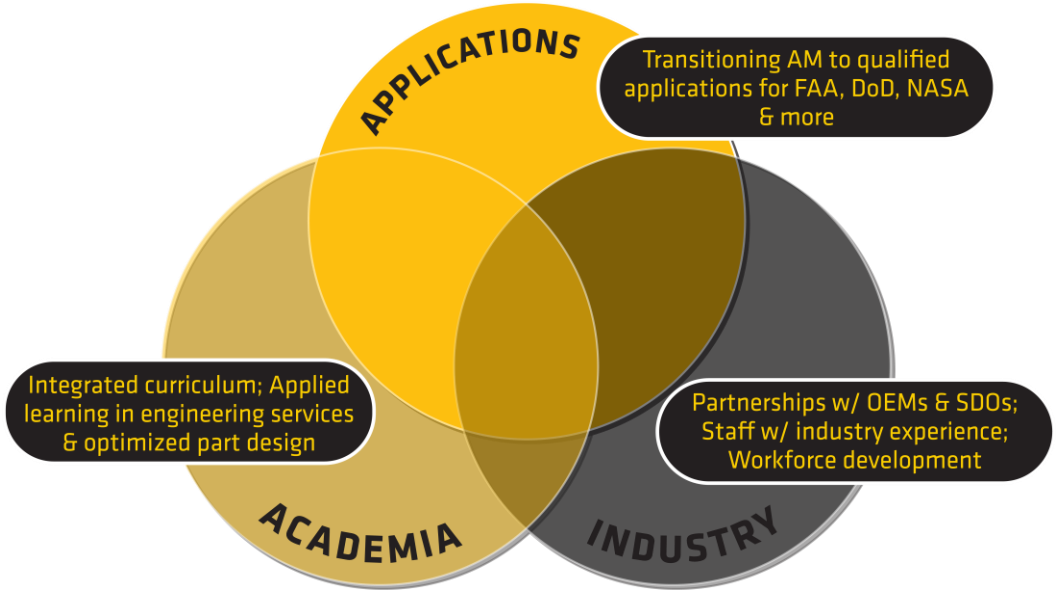
INDUSTRIAL MODERNIZATION OF MATERIALS & MANUFACTURING

SYSTEM AUTOMATION & DIGITAL MANUFACTURING

DIGITAL TRANSFORMATION & SUSTAINMENT MODERNIZATION

TEST & EVALUATION

ENGINEERING, CERTIFICATION, MODIFICATION & PROTOTYPING



Highlight of AM Projects

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Qualification & Certification

- **FAA JAMS – Polymer AM**
- **FAA JAMS – Metal AM**
- America Makes, Operational Qualification
- US Army DEVCOM Ground Vehicle Systems Center: MINT-GS

Data Management

- Workbench for Additive Materials (WAM) Database

Applications

- US Army DEVCOM Ground Vehicle Systems Center: MINT-GS
- US Army DEVCOM Aviation & Missile Center

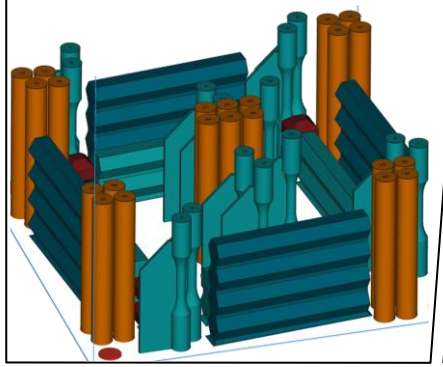
Consulting

- Generation of Additive Material Allowables for Ti-6Al-4V (GAMAT)
- OSD | JAMA
- America Makes | IMPACT Techno-Economic Analysis

Education & Workforce Development

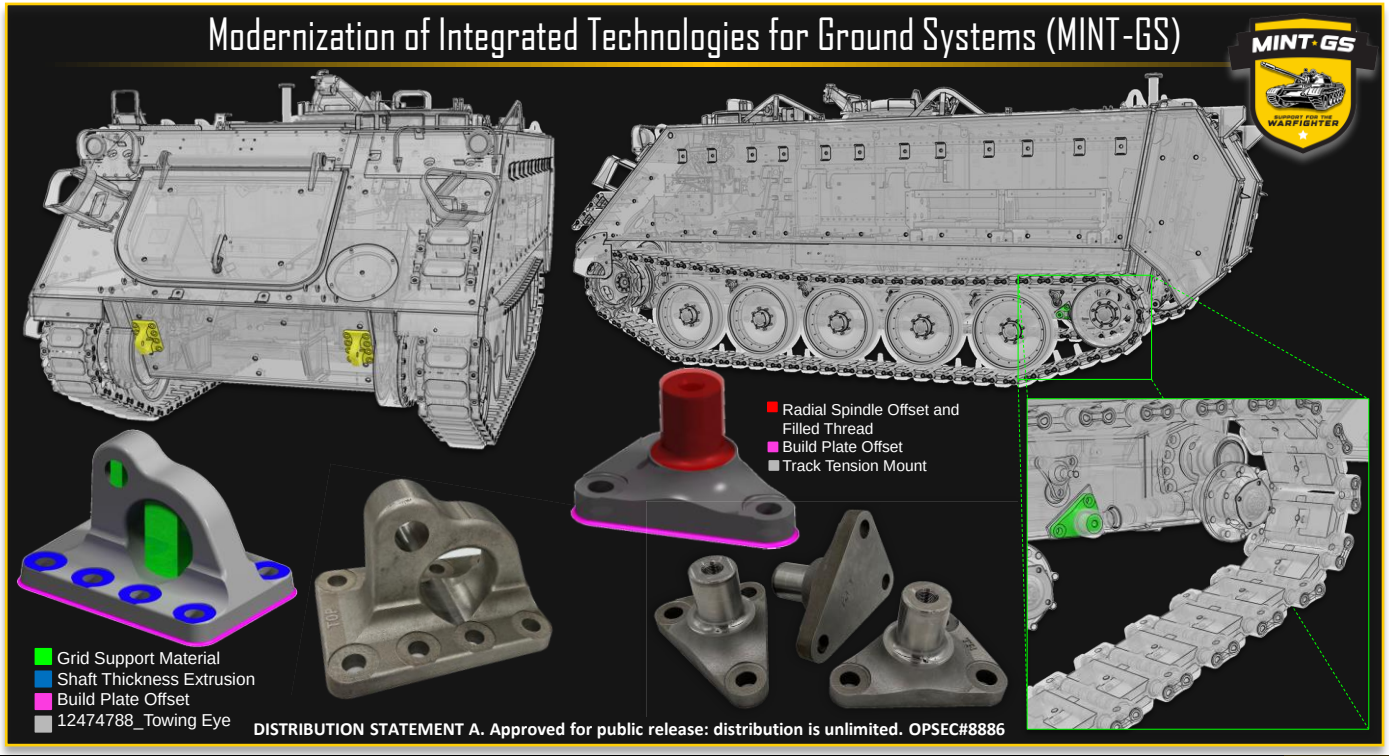
- American Rescue Act, Smart Manufacturing

Manufacturing



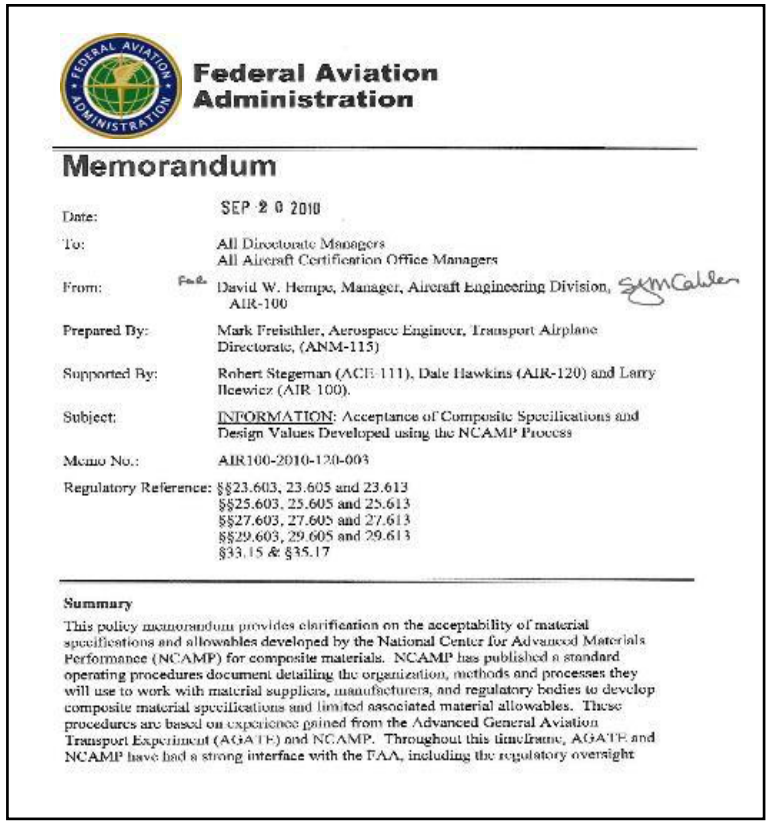
Material Characterization

Data Management



National Center for Advanced Materials Performance (NCAMP)

NCAMP works with the FAA, DoD and industry partners to qualify material systems and populate a shared materials database that can be viewed publicly.



Federal Aviation Administration

Memorandum

Date: SEP 2 0 2010

To: All Directorate Managers
All Aircraft Certification Office Managers

From: David W. Hempe, Manager, Aircraft Engineering Division, AIR-100

Prepared By: Mark Freisthler, Aerospace Engineer, Transport Airplane Directorate, (ANM-115)

Supported By: Robert Stegeman (ACE-111), Dale Hawkins (AIR-120) and Larry Ilcewicz (AIR-100).

Subject: INFORMATION: Acceptance of Composite Specifications and Design Values Developed using the NCAMP Process

Memo No.: AIR100-2010-120-003

Regulatory Reference: §§23.603, 23.605 and 23.613
§§25.603, 25.605 and 25.613
§§27.603, 27.605 and 27.613
§§29.603, 29.605 and 29.613
§33.15 & §35.17

Summary

This policy memorandum provides clarification on the acceptability of material specifications and allowables developed by the National Center for Advanced Materials Performance (NCAMP) for composite materials. NCAMP has published a standard operating procedures document detailing the organization, methods and processes they will use to work with material suppliers, manufacturers, and regulatory bodies to develop composite material specifications and limited associated material allowables. These procedures are based on experience gained from the Advanced General Aviation Transport Experiment (AGATE) and NCAMP. Throughout this timeframe, AGATE and NCAMP have had a strong interface with the FAA, including the regulatory oversight

EASA	CERTIFICATION MEMORANDUM
	EASA CM No.: EASA CM - S – 004 Issue: 01 Issue Date: 14th of January 2014 Issued by: Structures section Approved by: Head of Certification Experts Department Regulatory Requirement(s): CS 2X.603, CS 2X.605, CS 2X.613, CS-E 70 and CS-P 170

Metal AM Infrastructure

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Metal Additive Machines

LPBF
GE Concept Laser
M2 Series 5 (3)

LPBF
EOS M290 (3)

Powder DED
RPMI 222 (1)

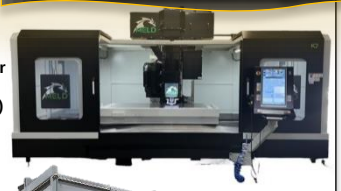
Powder DED
RPMI 557 (1)

DMG MORI
Powder DED
Hybrid
DMG Mori
LASERTEC 65 (1)

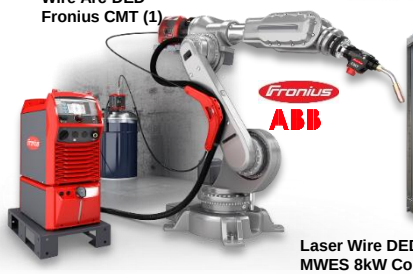
DMG MORI
LPBF
LASERTEC 30 SLM

VELO 3D
LPBF
Velo Sapphire 1MZ

Friction Stir
Additive
Meld K2 (1)



Wire Arc DED
Fronius CMT (1)



Laser Wire DED
MWES 8kW Co-axial (Future)

Polymer machines also available at NIAR.

Equipment investments exceeding $60-million in metal additive manufacturing infrastructure

Thermal Post Processing

Machining

AMP

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Hub for Advanced Manufacturing Research (HAMR)

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Hub for Advanced Manufacturing and Research

IMR
Industrial Modernization of Materials & Manufacturing

U.S. Department of Commerce: EDA Build Back Better Regional Challenge

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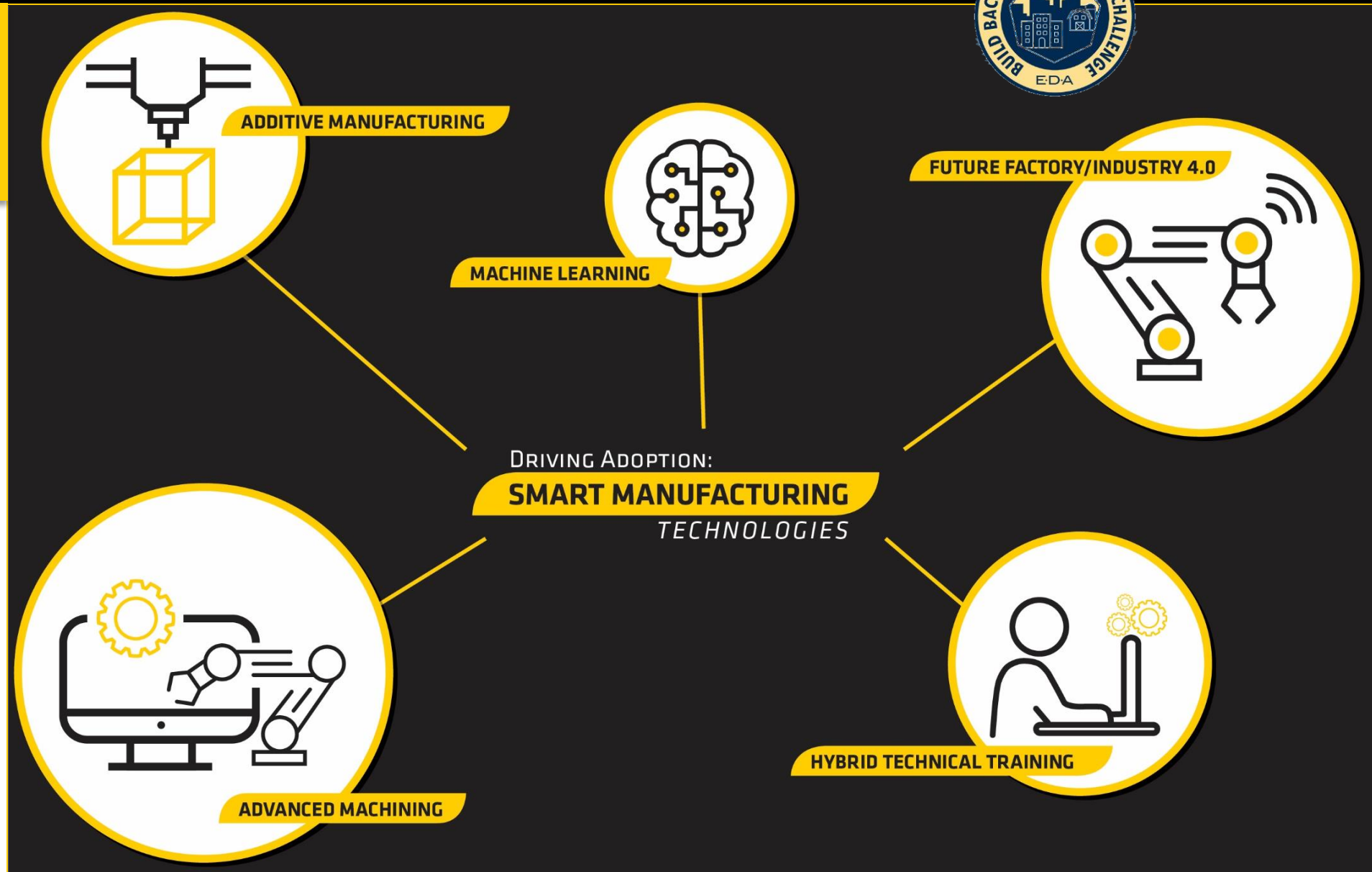
Wichita State University

Wichita State University is teaming with industry experts to develop a complete solution that enables small- and mid-size businesses to successfully implement additive manufacturing into their supply chain.

- Qualification Framework
- Material Standards and Databases
- Hybrid Technical Training
- Qualified Factory Development
- Qualified Factory



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FAA JAMS – Polymer AM | Program Overview

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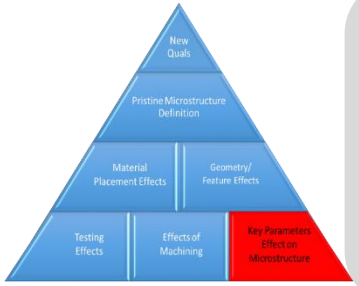
P-U9085 ULTEM 9085 Follow-On Activities



- Leverage completed ULTEM 9085 qualification for additional research studies to facilitate the understanding and application of ULTEM.
- Complete statistical analysis on equivalency studies.
- Provide guidelines on best practices on developing material specifications for extrusion.
- Develop standards that document best practices on testing material extrusion specimens.

P-HPEKK HexPEKK Qualification

- To develop a framework for the qualification of PBAM (LPBF) materials including guidelines and recommendations for their characterization, testing, design, and utilization using the NCAMP process.
- Transition of the test data and guidelines generated into shared databases such as Composite Materials Handbook-17 (CMH-17).

HEXCEL®

P-MONYX Markforged Qualification

Markforged

P-AN8X0 Antero 800 & 840 Qualifications

stratasys

- Enhance the framework for the qualification of PBAM (FDM) materials including guidelines and recommendations for their characterization, testing, design, and utilization using the NCAMP process.
- Transition of the test data and guidelines generated into shared databases such as Composite Materials Handbook-17 (CMH-17).

FAA JAMS – Metal AM | Program Overview

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M-JMADD — JMADD Joint Metal Additive Database Definition

- Establish a framework for developing statistically significant material databases of L-PBF metal AM materials.
- Expand the framework to additional AM machine types, powder reuse and other changes in the manufacturing process.
- Generate allowables and specifications for publication in MMPDS.

M-JMADX — JMADD Expansion

- Establish protocols for equivalency including both static and fatigue properties using established NIAR GE M2 Series 5 machine, specifications, process definition, to define and conduct a metal AM equivalency to JMADD dataset.
- Fatigue curves based on alternative post-processing (EOS M290).

M-MASFI — Surface Inspection

- Establish whether the as printed design values are largely related to crack propagation from the surface features (Np) and less by fatigue initiation (Ni).
- Determine if it is reasonable to print a test coupon with both an as-printed surface and a thermally induced crack.
- Evaluate both bulk material and surface feature NDI techniques to determine detectability of surface cracks.

M-NANPQ — New Alloy/New Process Qualification

- Establish a framework for developing statistically significant material database for large format metal AM.

M-BBFLP — Building Block

- Investigate feature-level performance debits for AM test articles via static test characterization.

Questions / Contact

- Rachael Andrulonis – rachael.andrulonis@idp.wichita.edu
- Brandon Saathoff – brandon.saathoff@wichita.edu

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