U.S. Air Force
Manufacturing Technology Program
Sustainable Aerospace Manufacturing Initiative

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David Madden
Processing and Fabrication Branch
Manufacturing Technology Division
Materials and Manufacturing Directorate
Air Force Research Laboratory

Integrity - Service - Excellence
Partnerships for Strong Industrial Base Capability for the Warfighter

Objectives

- **Reduced Costs** for Acquisition & Sustainment
- **Reduced Time** for Tech Transition / Manufacturing / Maintenance
- **Reduced Risk** when introducing New or Improved System Capabilities
- **Increased Availability** of technologies, materials, or components through shaping of industrial base

Manufacturing & Industrial Readiness Core Competencies for the USAF

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Strategic Vision Approach

Global Environment/Context

OSD, AF, AFRL Strategic Plans

N/M/Far S&T collaboration opportunities

N/M/Far AF Sector requirements

Current and Planned ManTech Tech Programs

N/M/Far Industry Inputs (e.g. IRAD, Workshop)

Strategic Vision
- Mission
- Thrusts
- Tech Roadmaps

RX Integration

AFRL & SAF leadership

AF Manufacturing Technology Vision 2025

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Vision & Supporting Strategic Thrusts

Moving Manufacturing Left
- Sponsor early development of game-changing mfg technologies and partner with academia and small business on high risk/high payoff opportunities
- Develop tools and methods that promote early consideration of mfg implications during concept development

Cradle To Cradle Digital Thread
- Increase digital density across life-cycle and ensure wide access to the same computer-based technical data/description of the product
- Enable increased reusability of materials and components, and optimize impact on the environment

Responsive, Integrated Supply Base
- IB capabilities and risks are known, available, and integrated into product development
- 21st century supply chain mgmt principles
- Capability for rapid formation of global partnerships

Next Generation Agile Manufacturing

Factory of the Future
- Next gen mfg technologies developed with process and cost models -- drive the factory and feed the Digital Thread
- Lean & agile, lot size insensitivity
- Green wrt the factory footprint
- Robotics and next gen automation
- Advanced/ wireless factory C2
“Sustainable manufacturing is defined as the creation of manufacturing products that use materials and processes that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers and are economically sound.”

Adapted from the Department of Commerce Definition

“Sustainability” and “sustainable” mean to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations of Americans. (From Department of Defense Executive Orders 13423 & 13514)
What SAMI Is!

**Proactively developing Sustainable Manufacturing technologies that achieve a balance between People, Profitability, & Planet**
- Safe for employees, communities, and consumers
- Use materials and processes that minimize environmental impacts and conserve natural resources including energy
- Economically sound

**Driving Forces for SAMI STRATEGY:**
- Security imperative
- Technical innovation
- Resource efficiency
- Advocacy from industry
- Tangible value
- Education
- Government policy
- Y not be the leader

**Reference documents**
- 2010 Air Force Energy Plan
- 2010 Strategic Sustainability Performance Plan
- Defense-Wide Manufacturing Science & Technology Program
- 2009 DoD ManTech Program Strategic Plan
- United States Code Title 10

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Driving Forces for SAMI

• Security imperative for the global military industrial base
  • AF Energy Plan: Make energy a consideration in all we do, including intensive mfg processes
  • Avoid industrial base disruption due to new regulations; e.g. overseas suppliers dealing w/REACH

• Technical innovation
  • New materials for defense applications (nano, bio); development of monitoring tools (MTConnect)
  • Need for transition pilots; AF requires alternate materials at MRL>=8 for transition

• Resource efficiency
  • Energy security and environmental stewardship are national imperatives for industry & government
  • AF ManTech Strategic Vision requires consideration of sustainable processes in future projects

• Advocacy from industry
  • ManTech strategic workshop theme; DMC track; new NDIA Sustainable Mfg subcommittee

• Tangible value
  • Profitability is a key incentive for resource & energy conservation; avoidance of environmental liability
Driving Forces for SAMI

• Education
  • Develop & mature methods for validation of tools & processes; consider creating case studies
  • Enable the IB to go from compliance to leadership in mfg processes for acquisition of weapons systems

• Government policy/regulations - current and future
  • Executive Orders 13423 & 13513 requiring federal agencies to develop sustainability plans
  • 2010 DoD Strategic Sustainability Performance Plan & 2010 USAF Energy Plan
  • 2009 DoD ManTech Program Strategic Plan; 2010 AF ManTech Strategic Vision
  • OSD Emerging Contaminants watch list; Toxic Substances Control Act reform on the horizon

• Y not be the leader for the defense Industrial Base
  • Develop core Industrial Base (IB) competencies to apply across the weapons systems community
  • Do not want IB to support mfg processes w/contaminants & high energy IF alternatives exist
  • Enhance IB credibility and reputation for sustainable mfg of weapons systems
  • NDIA is uniquely positioned to bring the IB together
Sustainable Aerospace Manufacturing Initiative

• Assess standards, tools, and metrics for relevant application to aerospace industry

• Develop projects to improve processes for metallic, composite, and electronic aerospace components

• Demonstrate technology enhancements in pilot production cells

• Use lessons learned as input to design for sustainability

Reducing the environmental footprint while increasing manufacturing capability
A Product “Life-Cycle”
- Focus on DoD Manufacturing
SAMI Program Summary

- Develop
  - Assessment process & tools
  - Assessment criteria
- Conduct assessments
- Analyze assessment results
- Develop sustainable machining cell
- Conduct industry study
- Identify future sustainable manufacturing opportunities

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Academic Study

• Utilize the Sustainable Manufacturing Partnership to conduct survey of academia for sustainable manufacturing activities
  • Identifying research and technologies with impact to DoD aerospace

• Serving as technical advisor to SAMI

• Organize Academic Workshop to be held on 10 March 2011 at UC Berkeley
  • Report of academia SAMI-related activities
  • Review technology maturity levels, methodologies, & transition possibilities of current research
  • Develop new partnerships & project ideas

• Initiating assessment of AF ManTech projects
Assessment Process

Pre-Assessment Questionnaire

Define Process Inputs/Outputs

Analyze Data

Collect Data

Report/Out-brief

Initial Trials At:
Assessment Sites

• Side by side comparison of machining centers

• Assessed machining cell at GKN St. Louis
  • Provided baseline for gauging improvements

• Assess turbine airfoil post processing facility in Madisonville, KY
  • Extends assessment process to ‘value stream’ like analysis

Assessments are cutting across DoD supply chain and identifying drivers for process sustainability

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Aerospace Machine Tool Industrial Base Assessment

- Identify and assess data analysis tools available for improving sustainability of aerospace DoD machining operations
  - Focus to be on analytical methods
  - Identify technology gaps and opportunities for expansion of existing data standards

- Assess US aerospace industrial base machining operations
  - Assess at least four facilities supporting the DoD aerospace industry
  - Identify and evaluate the capabilities of at least four machining “test bed” facilities
  - Describe in a common format the machining capabilities, existing data collection, and analysis techniques for the participating test bed sites

- Conduct and participate in meetings/workshops
  - Determine high payoff areas for future AF ManTech investments
  - Develop technology roadmaps for sustainable manufacturing of DoD assets

Seeking participants to join us!

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Sustainable Machining Production Cell
Progress Report

Cincinnati Magnum Production Cell at GKN - St. Louis, MO

- On-Site Assessment Completed
- Analysis Underway
  - Out Brief Scheduled for Mid-April
- Based on Preliminary Results, Initiated Coolant Recycling Program
  - Reduced Coolant Usage!
  - Instead of Paying to Haul Away, Waste Coolant is Now Sold!
Enabling Process Monitoring

Challenge: Integrate energy data with operational machine data

How much is the machine consuming for the task it is doing? Based on op data, when will maintenance be required?

Integrate operational and energy data using MTConnect interoperability standard

Enable decision making based on combined data

Optimized sustainable process

Source: System Insights, 2009

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Energy Monitoring for Defense Readiness and Availability

Machining Center Maintenance Indications

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Standardization in measuring energy consumption
SAMI Planning Process

**Industry Workshop**
- 24 February
- NDIA Huntsville, AL
- Review Objectives
- Brainstorm Technical Areas

**Academic Workshop**
- 10 March
- LMAS UC Berkeley, CA
- Assemble Academicians to Identify Relevant Research

**SAMI Roadmap Workshop**
- Week of 11 April
- GKN St Louis, MO
- Review Machine Tool Project
- Develop SAMI Roadmap

**National Sustainable Manufacturing Roadmap Workshop**
- 30 March – 1 April
- U K Lexington, KY
- Develop Framework for National Sustainable Manufacturing Roadmap

**SAMI Roadmap**

- Machine Tool
- Casting
- Forging
- Composite Fabrication

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Next Steps for

• Environment, Energy Security, and Sustainability NDIA Symposium
  - Participating in OSD session on Strategic Sustainability Performance Plan

• Continue to develop collaboration team
  - Consider benchmarking with commercial non-defense industry
  - Continue coordinating with NDIA SM subcommittee
  - AMMTIAC collaboration site to startup in Feb for controlled access sharing
  - NDIA workshop tomorrow—Review objectives, brainstorm tech areas for April workshop, discuss approach to policy/guidebooks
QUESTIONS??