ADDITIVE MANUFACTURING AND THE IMPACT ON THE DEFENSE INDUSTRIAL BASE 18892

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AGENDA

Introduction

Additive Manufacturing

DoD Interest

Industry concerns

Potential approaches

ADDITIVE MANUFACTURING

- **AM gaining maturity**
- **Industry expanding rapidly**
- **Potential is huge**
- **NASA has significant investment**
- **Very attractive to military**

WHY IS DOD ATTRACTED TO AM?

- **Enable spare parts fabrication at point of consumption**
- **Address diminished manufacturing sources and material shortage issues**
- **Potential to:**
  - Reduce supply chain & inventories
  - Improve responsiveness
  - Reduce manpower

DEFENSE INDUSTRY CONCERNS

- **Loss of spares business**
  - Sales volume
  - Historically higher margins
- **Additional benefits**
  - Stable workforce
  - Feedback on reliability and performance of system
  - Input to future systems designs
- **Development of a business plan to remain profitable with DoD using AM**

CURRENT STATE OF AM

- **Lack of industry standards currently limits use of AM**
- **Result: A short term solution is not required – now is the time to explore alternatives**
- **Challenge: If DoD is using AM for spares, what is the model for profitability/return on investment (ROI)**

INDUSTRY STANDARDS

- **ASTM, ISO, SAE and NIST all have AM standards initiatives**
- **Current status:**
  - Standardized terminology
  - Standard for software format for AM machines
  - Limited number of materials

NIST STATEMENT ON AM

Materials and processes used to produce critical components for defense, aerospace, and medical applications must first be formally qualified. Extensive empirical testing to fully qualify a material often requires many thousands of individual tests, costing millions of dollars and 5 to 15 years to complete. (i) Further, a minor change in the process requires complete re-qualification. The variety of AM processes available to users and the variety of process variables used to produce an individual part make statistical-based qualification through empirical testing particularly burdensome. (ii) Currently no AM processes or materials are qualified for critical defense or aerospace applications…

https://www.nist.gov/programs-projects/qualification-additive-manufacturing-materials-processes-and-parts

OTHER INDUSTRY CONCERNS

- **OEM concerned about potential liability:**
  - Replacement component is made using materials, machines and processes specified by OEM.
  - Standards do not exist for processes and materials
  - Component not formally “qualified” through testing

INDUSTRY OPTIONS

- **Stop pursuing DoD contracts**
- **Increase prices on production items**
  - Assuming limited follow-on business for spares/repairs
- **Offer contractor logistic support using AM**
- **Charge high prices to deliver AM design and process data**
- **Use royalties structured to obtain ROI for each item produced using AM**
- **Address liability issues in contracts**

POTENTIAL APPROACHES

- **Contractors install/operate AM machines at depots**
- **Licensing of software, processes**
- **Clearly define what will be replicated by services, what will not be**
- **Use contract options to provide flexibility (spares, licenses, etc.)**

SUMMARY/RECOMMENDATIONS

- **AM is already used to a limited extent in manufacturing**
- **Military logisticians see this as a "panacea" to reduce inventory, provide responsive support**
- **Industry is concerned that current models for ROI will not apply**
- **Acquisition, life cycle support and IP strategies must consider the future use of AM in support facilities**

BACKUP

INDUSTRY STANDARDS

ASTM, ISO, SAE and NIST all have AM standards initiatives

ASTM:

- **Committee F42** (**https://www.astm.org/COMMITTEE/F42.htm**)
- **Three proposed metal material standards:**
  - WK51329 Additive Manufacturing Cobalt-28 Chromium-6 Molybdenum Alloy (UNS R30075) with Powder Bed Fusion1
  - WK48732 New Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with Powder Bed Fusion
  - WK53423 Additive Manufacturing AlSi10Mg with Powder Bed Fusion

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ISO:

- **ISO/TC 261 – Additive Manufacturing (http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=6290860)**
- **ISO/ASTM 52915:2016 Specification for additive manufacturing file format (AMF) Version 1.2**
- **Five others on terminology and general principles**

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SAE:

- **Held first meeting on AM standards in July 2015**
- **Upcoming AM Symposium – Knoxville – March 2017**
- **Four standards in process for Aerospace Material Specification**
  - Three on Ni based alloys
  - One on the laser bed fusion process