Additive Manufacturing – Challenges for the Systems Engineer and Program Manager

October 25, 2017

Bill Decker
Defense Acquisition University
7115 Old Madison Pike
Huntsville, AL 35806
724-612-0999
For further info: john.rice@dau.mil

www.DAU.mil

Ground rules

- This is a discussion, not a lecture
- Your opinions and viewpoints are welcomed
- There are no right/wrong answers

Agenda

- Introduction
- Additive Manufacturing (AM)
  - Defined
  - Advantages
  - Disadvantages
- What does this mean to PM?
- What does this mean to the Systems Engineer
- Discussion
  - How can we use AM? Now? Future?
- Conclusion

Introduction

- Additive Manufacturing is “hot topic”
  - Parts for production of airliners (Embraier and Airbus)

Allows airlines to customize interiors
Cost effective for LRP
Parts may be optimized for each application
To this point – no flight safety critical components

Additive Manufacturing

- What is it:
  - Objects are built up from a precursor material (powder)
  - Generally a uniform material
  - No molds, minimal machining
  - Great design freedom

AM Advantages

- Minimal tooling required
- Make many parts from “bucket of precursor dust”
- Cost effective – especially for small quantities
- Flexible – easier to make changes “on the fly”

AM Barriers/Risks

- Minimal standards for:
  - Materials
  - Processes
  - Qualification of machines
- Repeatability is likely only on one machine, in one location
- Qualification/certification of parts important
- Intellectual property issues – TBD
  - Being discussed by legal community

Systems Engineers' Concerns

- Contractor proposes to use AM part(s)
  - Is (are) the part(s) critical to operation?
    - Flight safety, safety of personnel, mission critical?
    - If no, then less to be concerned about
  - Is it proposed to make the part(s) in more than one location?
- Government proposes to use AM to make spares/perform repairs
  - Is (are) the part(s) critical to operation?
    - Flight safety, safety of personnel, mission critical?
  - Is it proposed to make the part(s) in more than one location?

SE Concerns (cont'd)

- Contractor proposes to use AM parts (cont'd)
  - Do the precursor materials meet a standard?
    - ASTM has only three metal powder standards as of Oct 17

    https://www.astm.org/Standards/additive-manufacturing-technology-standards.html
  - Have the AM machines been qualified?
    - No universal standards exist today
    - How have they demonstrated repeatability?

SE Concerns (cont'd)

- Potential problem areas (current state of AM)
  - Each part/component will require qualification
  - Are unique test procedures and equipment required for systems with AM components?
  - Future parts may require machines and processes that are no longer available (DMSMS)
  - Does the DoD plan to make parts using AM for repair?
    - Intellectual property licenses
    - Machine qualification at site of use
    - Are we sole source for material? Machines?

Discussion/Questions

- How can we use AM? Now? Future?

Conclusion

- AM for prototypes is often a great option
- AM for production is not yet ready for prime time
- AM is well suited for non-critical parts
- AM is flexible, and often cost savings