Panel Discussion Topics

Aeronautics and Space Engineering Board
National Academy of Sciences, Engineering and Medicine
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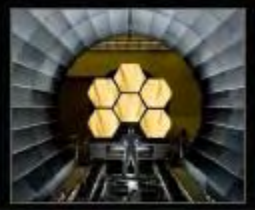
Beckman Center
Irvine, California








marshall

R.G. Clinton, Jr.
Acting Manager, Science and Technology Office
NASA, Marshall Space Flight Center

What Corollary or Overlapping Technology Development is (i) Required for Acceptance and (ii) Will Accelerate the Adoption of AM Among Higher Criticality Applications?

How Could the Government Support and/or Stimulate AM to Greater Benefit US Aerospace?

Material Relationships (Understanding the basics)	In-Process Controls (Controlling what you do)	Post-Process Controls (Evaluating what you get)
Challenge: Understanding of the AM process-structure-properties-performance relationships (in operational environments) is necessary for critical applications, yet also costly and time-consuming. Few data are available in open literature. Commercial AM adopters tend to hold their relationship data as IP.	Challenge: AM is an emerging and evolving technology with virtually no process history apart from extrapolation to weld and/or casting methods. Understanding AM process failure modes and effects, identifying observable metrics, and establishing process witnessing methods is essential to part reliability.	Challenge: AM parts with as-built surface roughness, non-uniform grain structure, and/or internal surfaces challenge the capability of standard NDE methods. Quantified NDE methods for AM material and feature must be established in support of NASA's damage tolerance qualification methods.

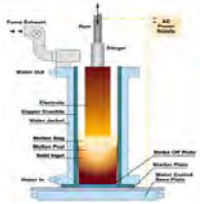
- Standards and benchmarks	- Actively support & participate in the commercial standards community
- Advancement of new technologies in the areas of process modeling	- Fund basic research for process modeling, ICME (integrated computational materials engineering)
- Understanding of process failure modes	- Fund SBIR/STTR for process monitoring and inspection (NDE)
- Advancement of new technologies in the areas of in-process and/or post-process NDE	

Develop Our Own Understanding of and Requirements for Additive Manufacturing

There is more to AM than manufacturing…

AM machines create a unique material product form – typically the purview of the foundry or mill

Subtractive Forging Process

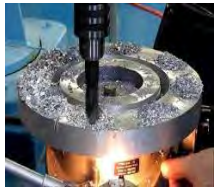

1. Ingot Making


2. Cutting


3. Heating


4. Forging

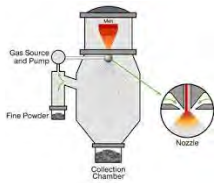

5. Heat Treating


6. Machining


7. Inspection


8. Delivery with CoC

Additive SLM Process



1. Powder Making


2. Printing


3. HIPing


4. Heat Treating


5. Machining


6. Inspection


7. Final Part