EXPLOREAND COLLABORATE

AMERICAN INDUSTRY AND AMERICA'S NATIONAL LABS

MATERIALS FOR ENERGY APPLICATIONS

Pratt & Whitney
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Industry Perspective
Additive Manufacturing

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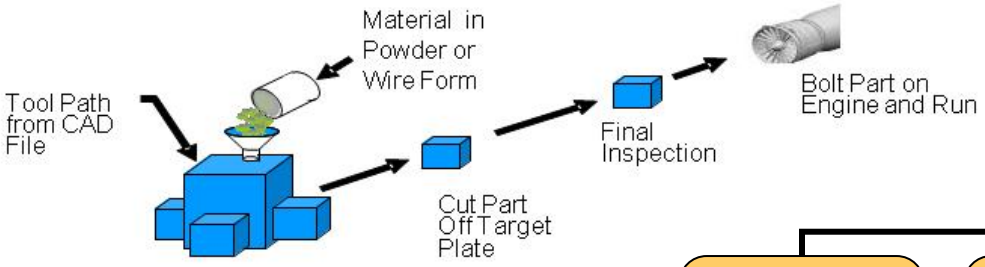
Background

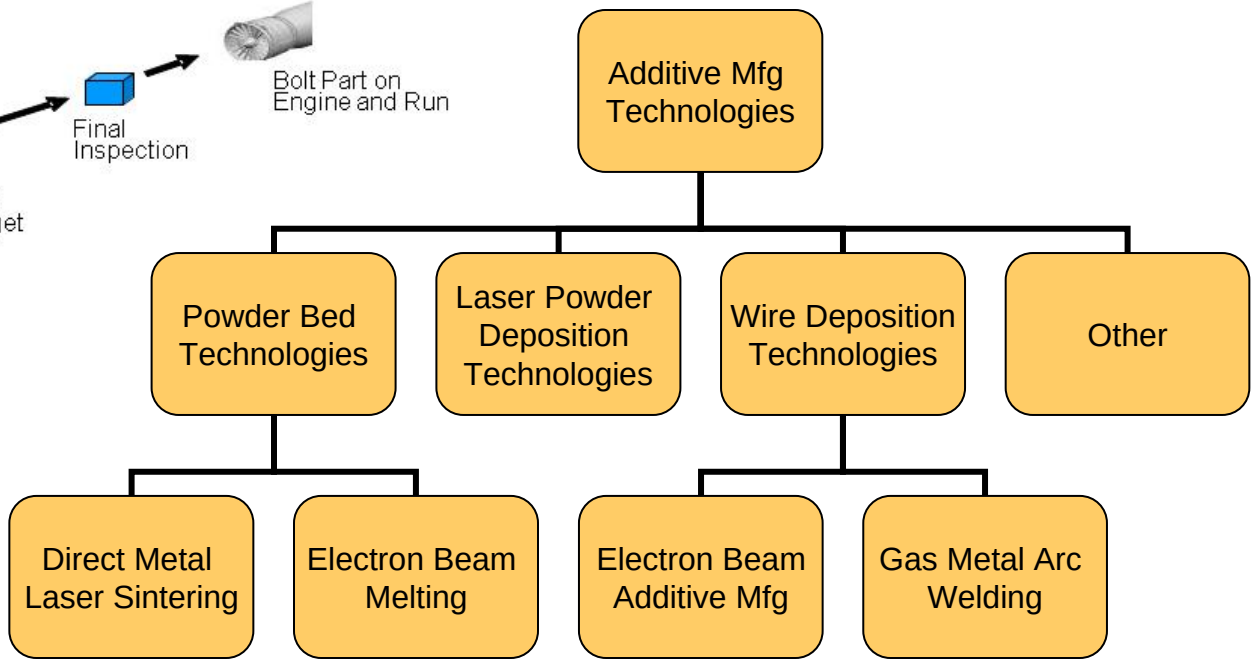
- Safety is Always # 1 Priority
- Fuel Prices Continue to Escalate
- Weight Reduction (Aircraft/Engine) ~1,000 lb is ~1% Fuel Burn Reduction
- New Materials Development/Component Certification >10Y/$10M/Process Variant

Motivation

- The ability to seamlessly manufacture turbomachinery and other systems directly from computer-aided design (CAD) files
- Embedded Structures, Tailored Materials, Integrated Part Consolidation, Lightweight Structures, Complex Geometries and Advanced Aero Performance can be Made Possible through Energy-efficient AM Platforms

Additive Manufacturing Technologies





Benefits:

- Design Flexibility (no Tooling Constraints, Complex Models)
- No Hard Tooling, No Material Lead Time, Reduce buy-to-fly Ratio
- Automated Process, Reduced Development Expenses, Faster Development
- Reduced Manufacturing Costs, Parts-on-Demand
- Near Wrought Properties, Near-net Shape Part

Issues, Barriers & Recommendations

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Issues:

• Cost, Speed, Validation, Scale (Size and Volume) !

Barriers:

• IP, Metrics, Perception (“What” If *vs* “So What”)

Recommendations:

• Development of Integrated Design/Manufacturing/Materials Computational Tools Initiative
• Process Modeling, Network of Manufacturing Demonstration Facilities
• Rapid Development Cycle Time (Fast Iterations Between Critical Gates)
• Rapid qualification methods (Materials Testing, Component Validation, Probabilistic Modeling)

• Find the Right Listening Party/Stakeholder
• Reward Successful National Labs-Industry Collaborations