

Extending the Digital Thread Into Additive Manufacturing

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GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2018



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Introduction

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- **Agenda**
- **Impact of Additive Manufacturing on A&D Supply Chain**
- **Considerations on when to use additive vs traditional**
- **Key CAD features that are driven by AM**
- **Where AM belongs in the digital thread/product lifecycle**
- **Additive Manufacturing in a ‘day in the life’ of a typical program**
- **Q&A**

Impact of AM in the global A&D supply chain

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AM attributes compared to traditional manufacturing	Impact on product offerings	Impact on supply chains
Manufacturing of complex-design products		
New products that break existing design and manufacturing limitations		
Customization to customer requirements		
Ease and flexibility of design iteration		
Parts simplification/sub-parts reduction		
Reduced time to market		
Waste minimization		
Weight reduction		
Production near/at point of use		
On-demand manufacturing		

Potential impact	Very high	High	Medium	Low

Source: Deloitte analysis.

Graphic: Deloitte University Press | DUPress.com

When does additive make sense?

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Reasons to use additive over traditional...

- **Cost – Low rate production may be cheaper than a traditional sourcing contract**
- **Cost – It may be cheaper to print a part than to conduct traditional provisioning, kitting, warehousing, shipping etc..**
- **Obsolescence – You may not be able to obtain the part**
- **Speed – You need it quickly in a certain location (AOG etc)**
- **Performance – It fulfils a specific requirement in a superior way – Weight, Strength, Material...**

Proof points

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Why Use Additive Manufacturing?

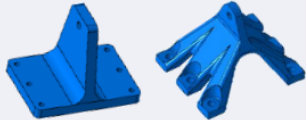
Current State of the Art



- Significant improvement in design and manufacturing capabilities
 - Faster process to design and build parts
 - Digital assembly: Reduce part count and entire manufacturing cycle
 - Eliminate tooling

Demonstrated Efficiencies on NGC Programs

Aircraft Bracket



High temperature polymer compared to traditional aluminum

- Cost reduced 37% savings
- Lead time reduced 78%
- Weight reduced 40%

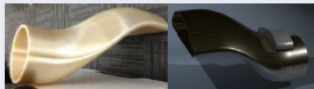
Warm Air Mixer



Compared to vendor quotes for functional components

- Part cost reduced 31% to 35%
- Lead time reduced 80% to 90%
- First AM built metal part to fly on DoD aircraft

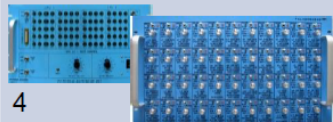
Composite Tooling



Compared to traditional prototype tooling

- Cost reduced 78% savings
- Lead time reduced 70% reduction

Software Test Panels



Compared to previous acquisition process

- Cost reduced 96% reduction
- Lead time reduced 99% savings

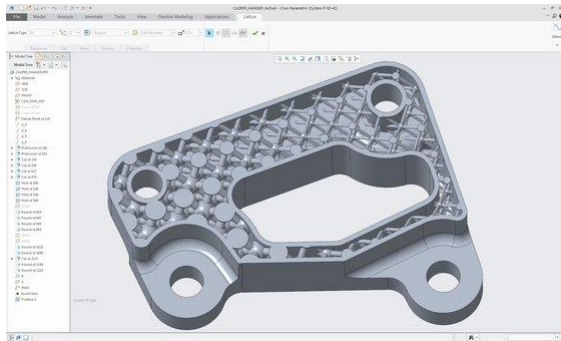
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Approved for public release: NG17-1259, 6/12/17

CAD Features driven by AM requirements

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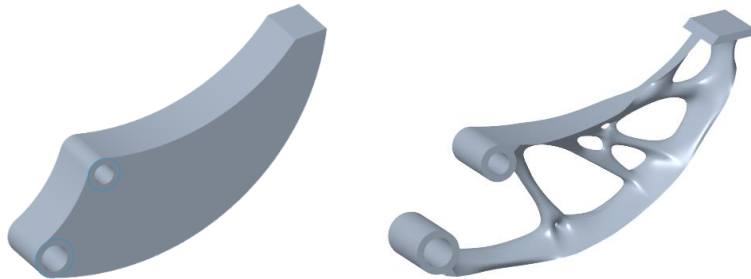
- **Lattice Creation**



- **Printer Support**



- **Topology Optimization**

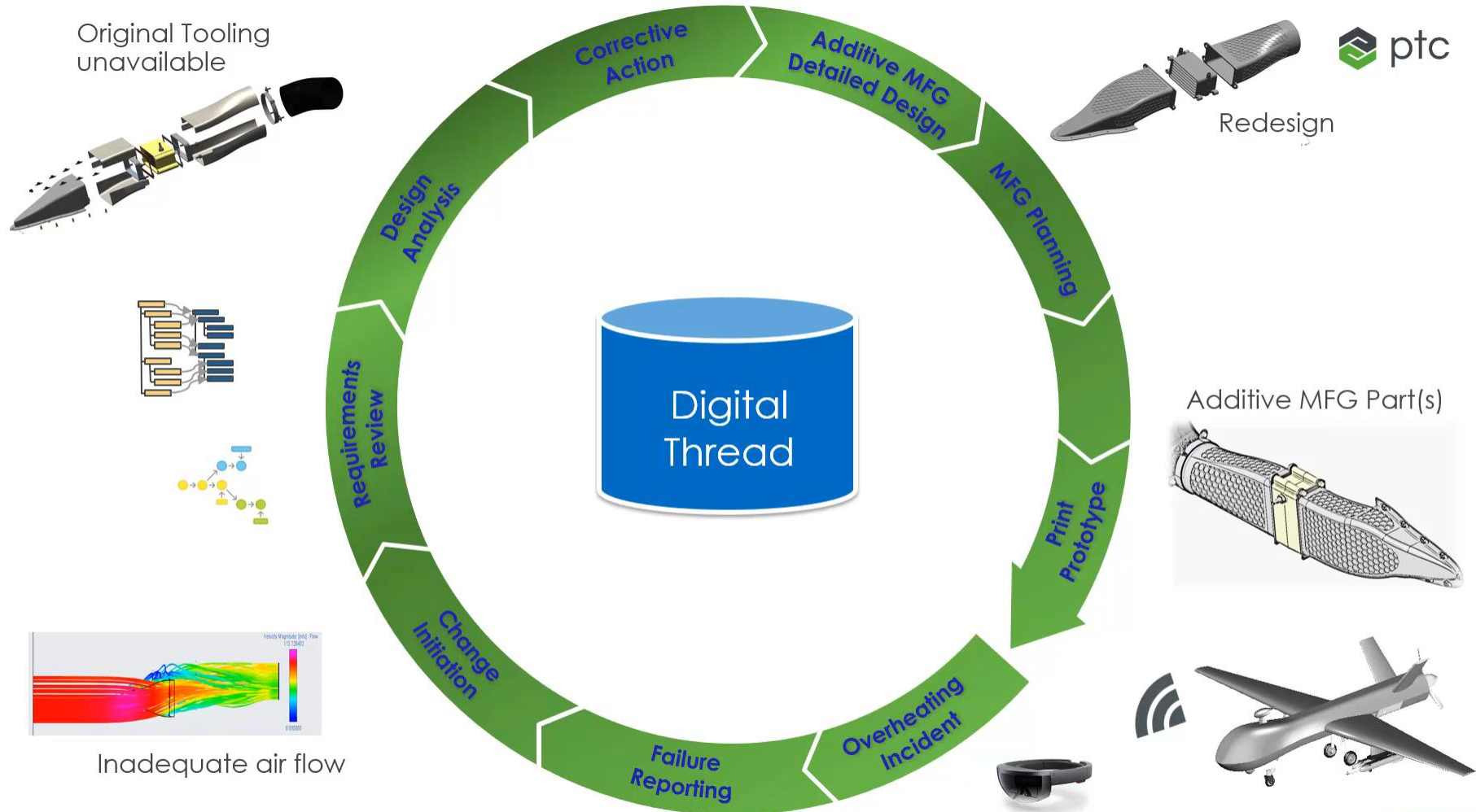


- **Manufacturing Processes**



Demonstration - AM in the context of a typical program...

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Summary

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- **Additive Manufacturing (AM) is disruptive technology and growing rapidly**
- **AM can add unique capabilities to a program by inserting the ability to ‘print your own’ parts to solve specific challenges**
 - **Obsolescence**
 - **Time, Logistics Delay**
 - **Performance (Weight, Strength etc.)**
 - **Cost in the supply chain (warehousing, kitting, provisioning, transportation)**
- **The decision to use AM must be driven by business requirements and CBA – what waste are you eliminating with AM?**
- **Companies that embrace MBE and have a digital thread strategy will find it easier to integrate AM into their supply chain**

Thank you

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Questions?