



High Temperature Additive Architectures for 65% Efficiency DE-FE0031611

Joe Weber, GE Power
Lyndsay Kibler, GE Power

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Agenda

- Impact of Additive at GE
- Industrial Gas Turbine Terminology
- Turbine Vane Conventional Cooling Fundamentals
- Program Objectives
- Additive Modalities
- Next Steps



Impact of Additive at GE



Performance

- Removes traditional mfg. constraints
- Enables “near surface” cooling



Speed to Market

- Model to part directly
- ~18 month cycle



Cost

- Eliminate casting tooling
- Metal only where needed

Improving state-of-the-art

Processing sciences



Alloys



Design



Advanced Manufacturing Works - Greenville

Merging design and manufacturing technology to deliver better products



Additive

- >10,000 parts shipped
- 1st GT parts produced/fielded

Ceramics

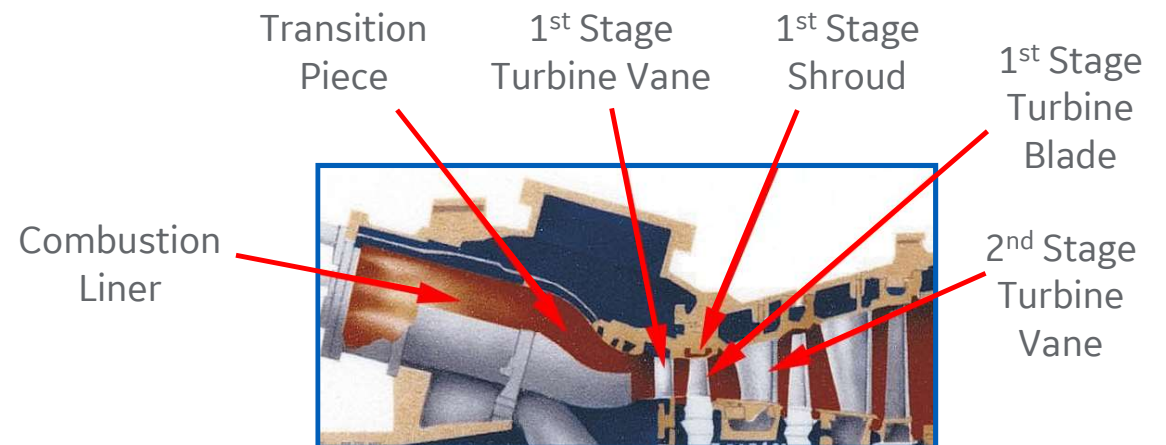
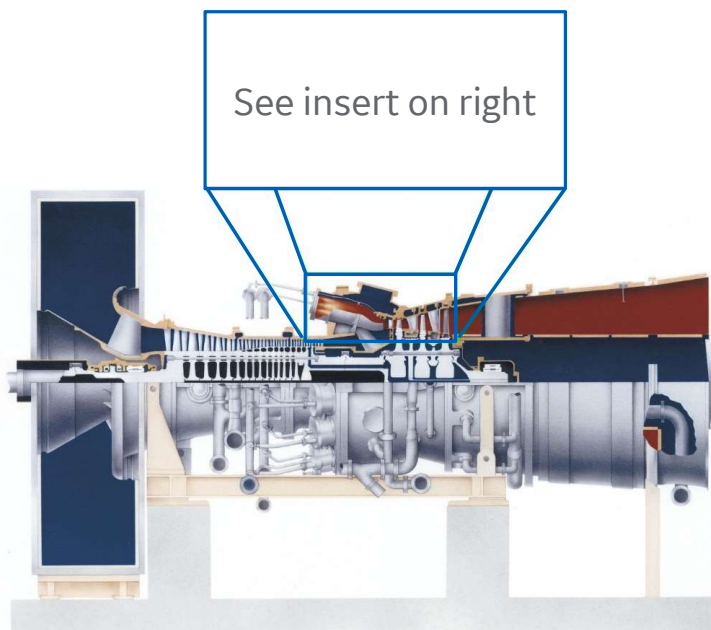
- 1st fielded CMCs
- Thermal coatings

Process optimization

- Automation/CMT/Digital
- HGP Special Processes
- Reduced cost and lead time

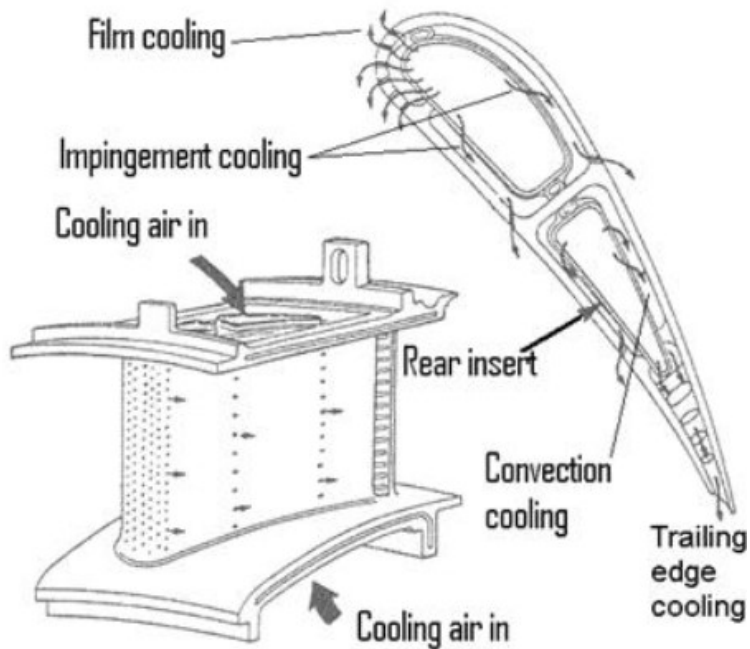


Industrial Gas Turbine Terminology

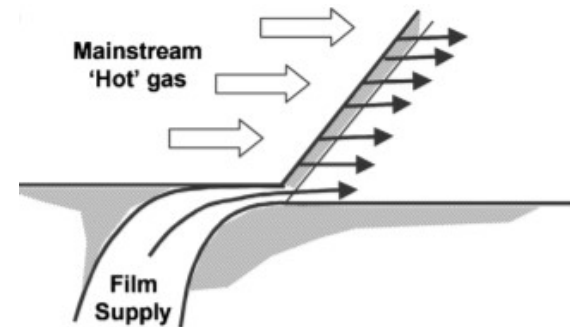
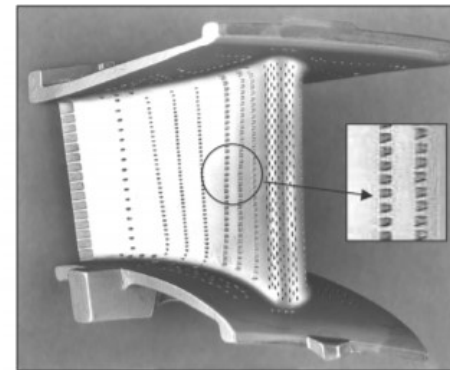


Turbine Vane Conventional Cooling Fundamentals

Internal Cooling Flow Circuit

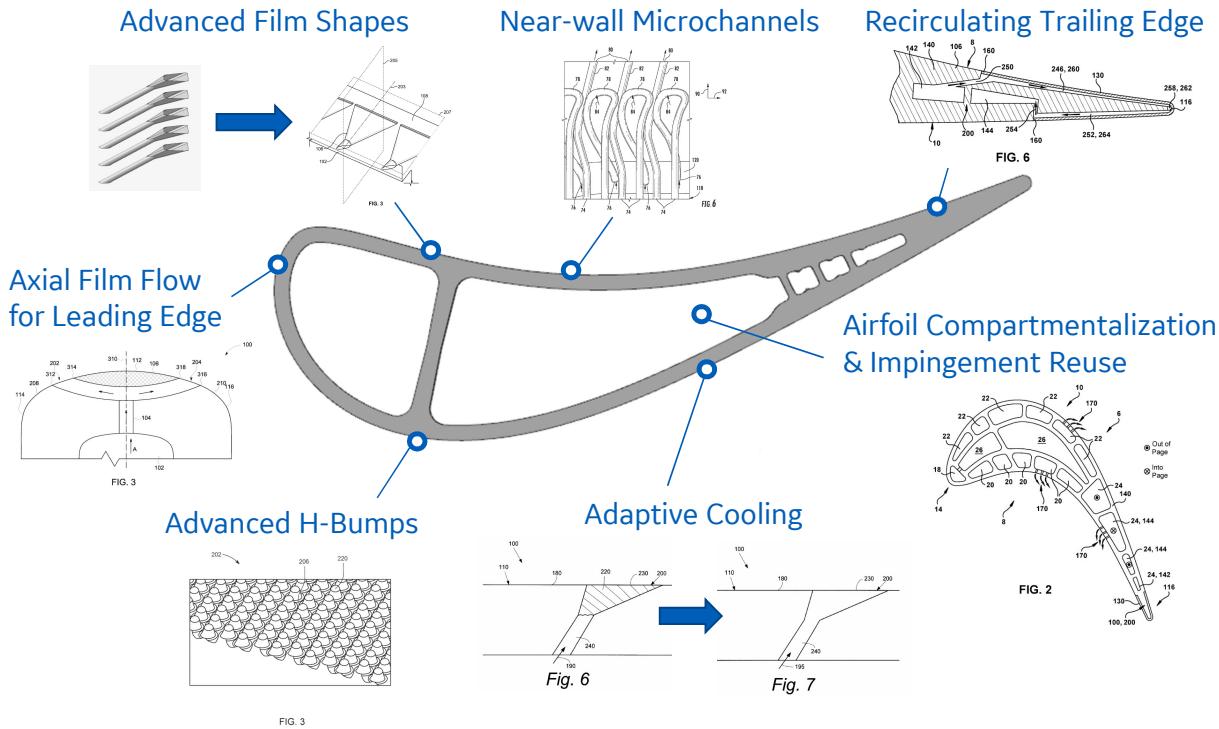


Surface/External Film Cooling

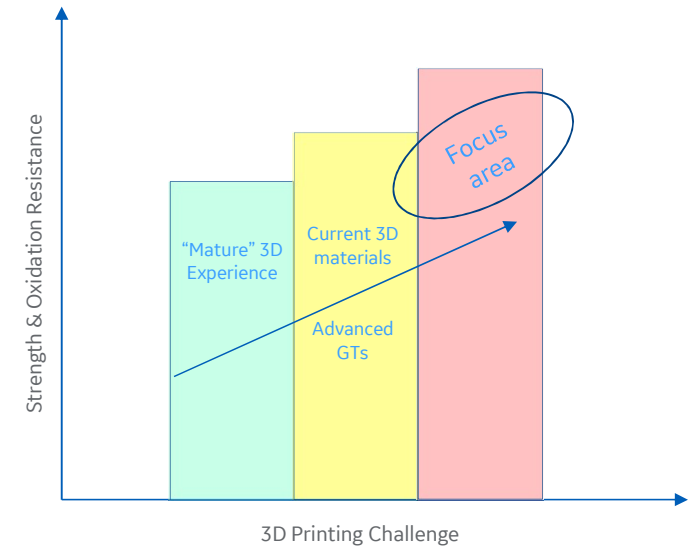


Program Objectives: Phase I – Discovery

Conceptual Design & Feasibility



Additive Modalities & Materials



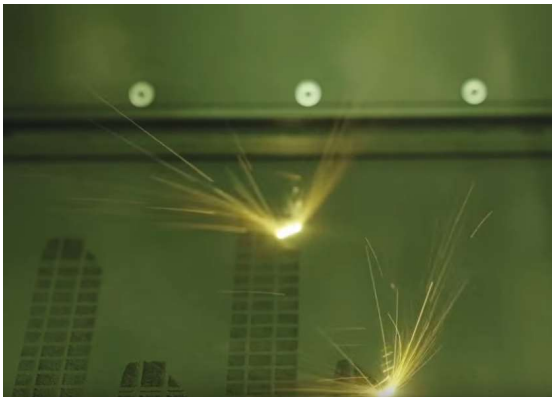
Program focus will be on high-temperature alloys, and additive modalities that enable their use



Additive Modalities

DMLM

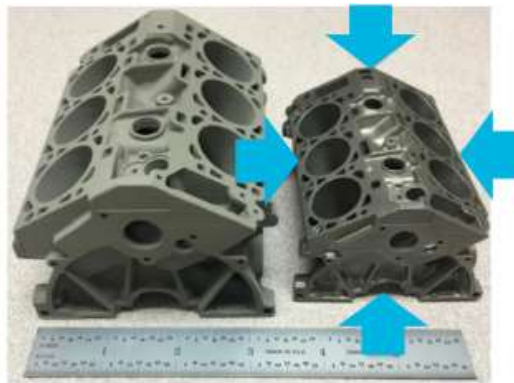
Direct Metal Laser Melting



High-resolution laser sintering process; ideal for complex features and uncastable internal geometries

Binder Jet

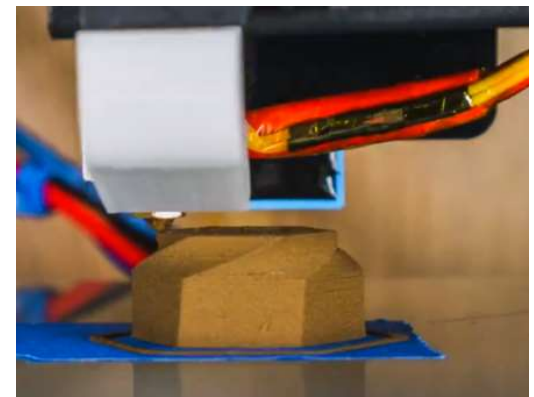
The Original “3D Printing”



Powder bed method that uses polymer binder to hold layers together; results in fully dense part after sintering

FDM

Fused Deposition Modeling



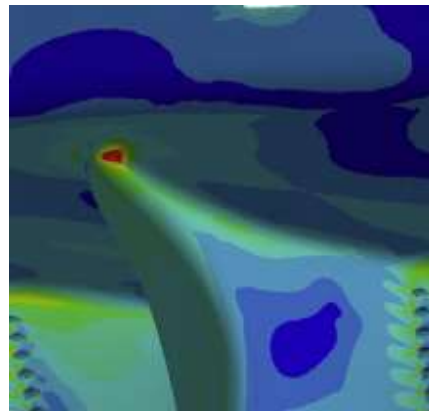
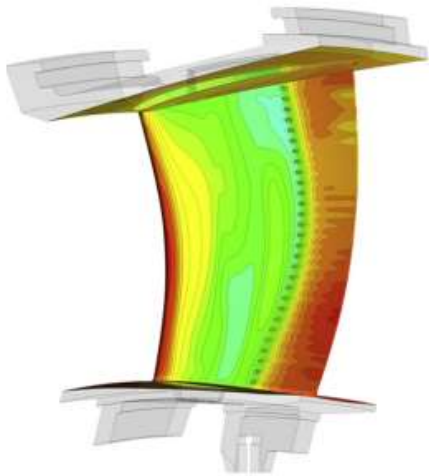
Metal-infused filament results in fully dense part after sintering



Next Steps

Conceptual Design & Feasibility

FEA Analysis: Heat Transfer & Structural



Additive Modalities & Materials

Coupon Print Trials

