

Advanced Materials and the Mobility of Production Functions

Peter Warrian PhD

University of Toronto, IPL

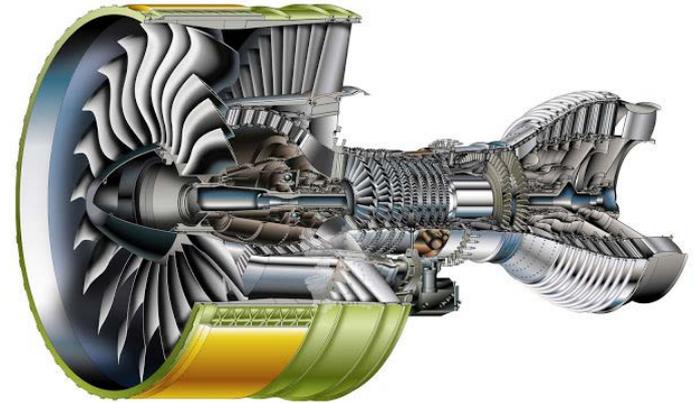
Theme 3: Research Issues

- 2014-2016
 - Advanced Materials
 - Additive Manufacturing
 - SMEs & Knowledge Transfer
 - Internet of Things
 - Industry 4.0
- Theme: The Digitization of Production Value Chains

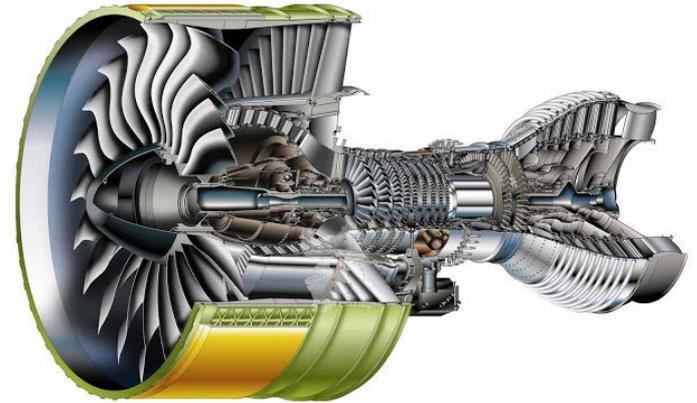
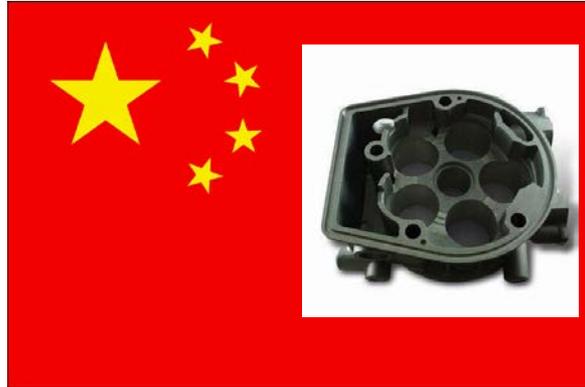
Tool, Die & Molding Case

- Windsor ON: TDMM Cluster
 - 300 firms; 4 of 10 in NA
- Competition from China Plastics Injection Molding Industry
 - Injection Moldmakers
- Digitally enabled mold design & processing

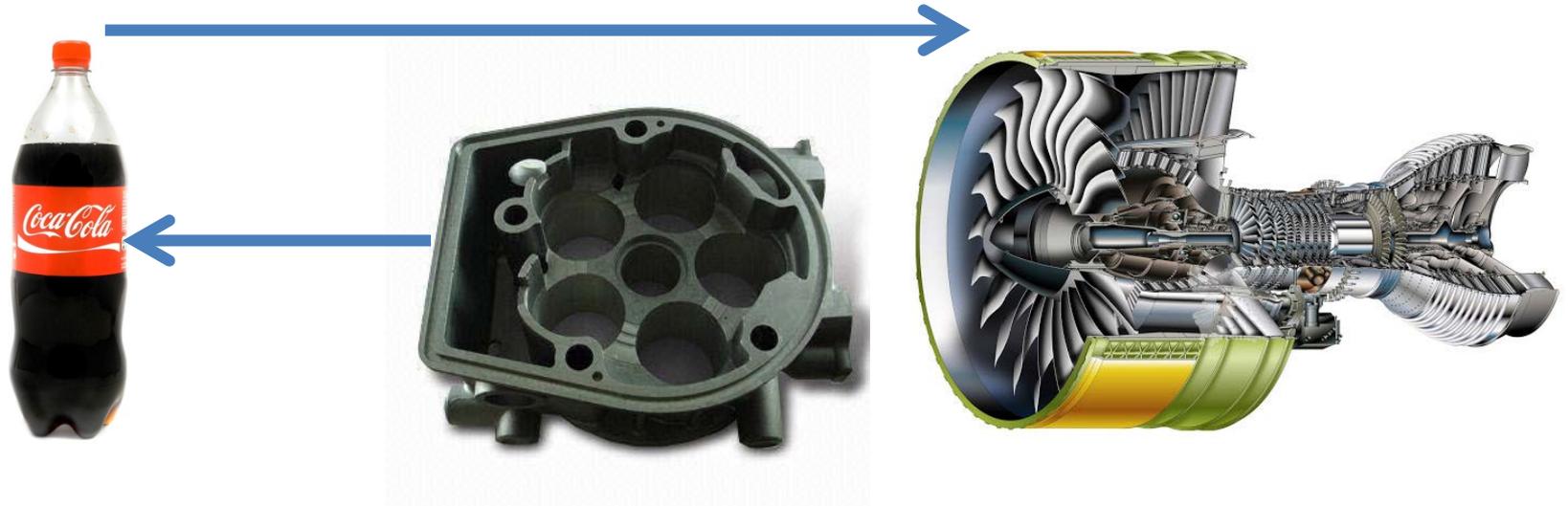
AM & Plastics Injection Molding



AM & Plastics Injection Molding



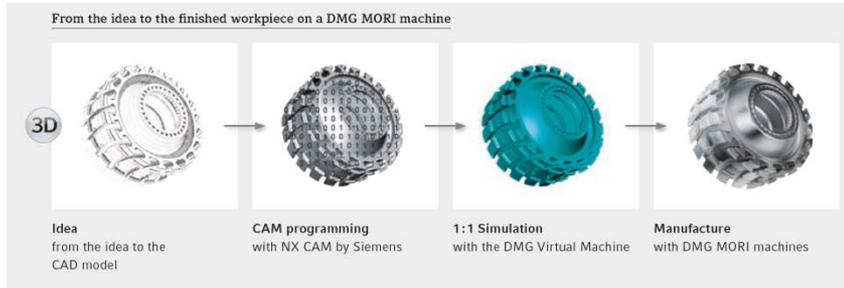
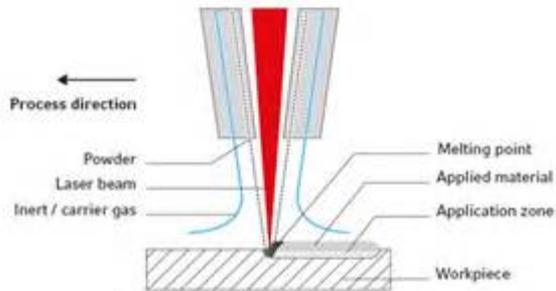
AM & Plastics Injection Molding



Injection Molding Engineering Ratio

- Environment & Light weighting: Coke & Cars
- Advanced Materials & Machining
 - Key Engineering Ratio
 - *Wall Thickness / Height of Container*
 - *Ratio: 1:200*
 - *Failure Rate: 0.001 inches*
- Good Enough for Coke then good enough for Aerospace.
 - Enabling technology: Hybrid Metallics Additive Manufacturing & Advanced CNC

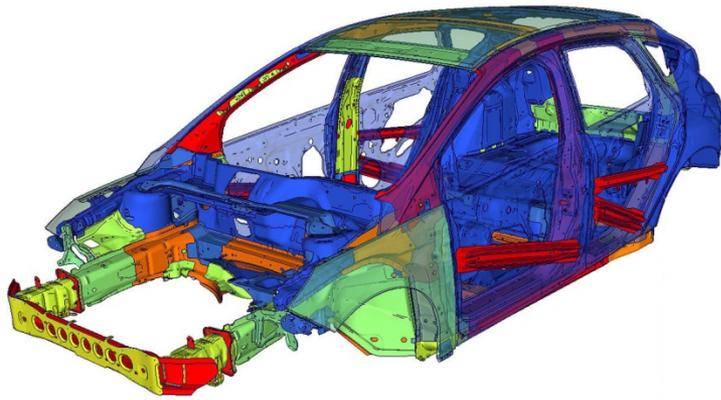
Hybrid AM CNC Technology



Auto Steel Case

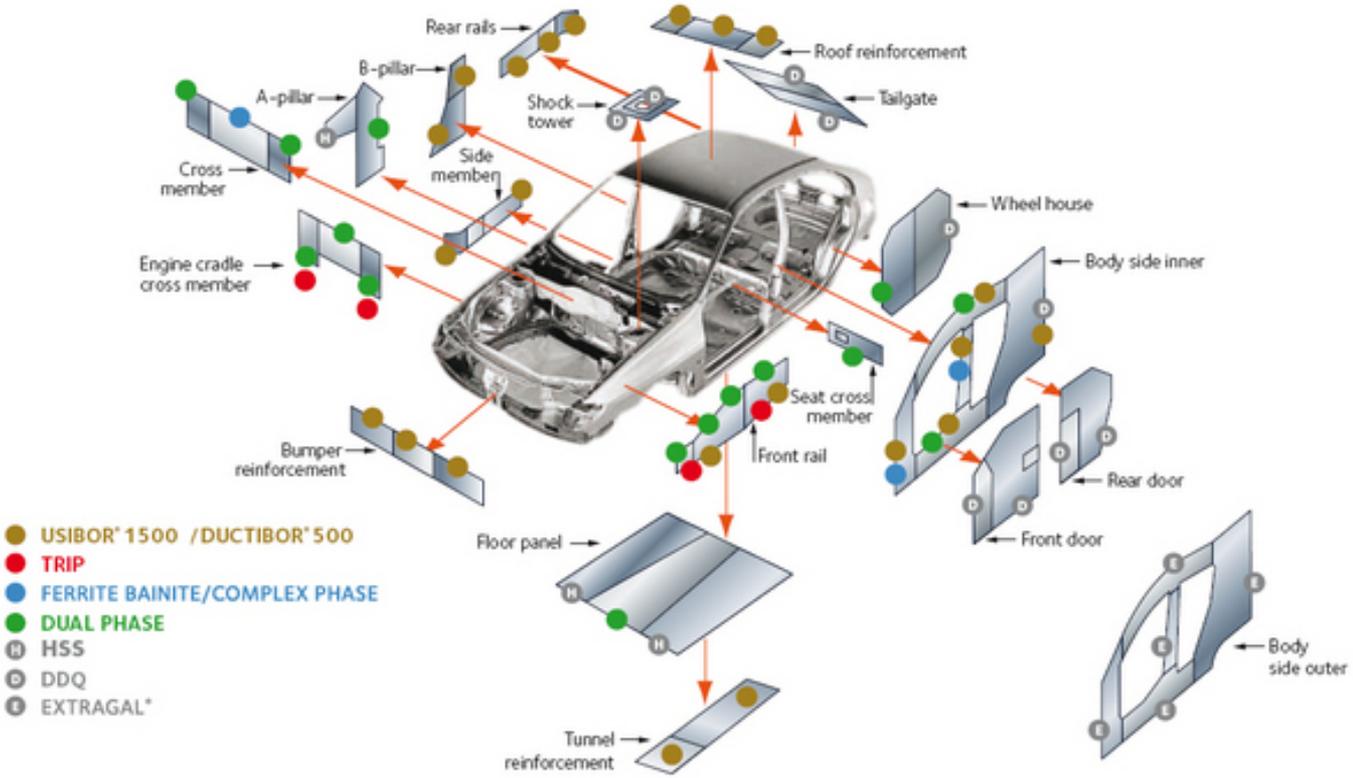
- New Materials Enabling New Design
 - Visualization, Simulation & Assembly
- Additive & Digital Manufacturing
 - New Geometries. Simulate BIW & New Steels
- CAFÉ Standards: OEM, Tier 1 Supplier, Steel Company
 - Design solution from Steel Company
 - Neither Design nor Steel existed previously

Simulating the BIW for New Steels



Arcelor Honda Door Ring

BIW Open Source Parts



New Steels & Auto Design Cycle

- Old 5 Year Design Cycle
 - Year 1: OEM Signs off on Platform Design
 - Year 2-3 Tier 1 and Lead Stampers included
 - Year 4 Steel & material suppliers included
- New 5 Year Design Cycle
 - Year 1: OEM Signs off on Platform Design
 - Year 2-3 Tier 1, Lead Stampers & Steel Companies included
 - Year 3-5 steel companies act as material advisors to stampers

Conclusion

- New Advanced Materials as Enabling Technologies
 - Manufacture with an advanced material that allows new geometries and designs to emerge
 - Materials enable microstructural manufacturing of new complex assemblies
- Shift in Boundaries of Firms along the Value Chain: Design-Manufacturing-Assembly