UTSR - ADVANCED MANUFACTURING PANEL

David Teraji

A CULTURE OF CUSTOMER CARE
Based in San Diego, California, U.S.A.

Founded in 1927

World’s Largest Manufacturer of Industrial Gas Turbines (1 to 22 MW Range)
- More than 15,000 Gas Turbines Operating in over 100 Countries
- More than 2 Billion Fleet Operating Hours

Oil & Gas and Power Generation Markets

134 Turbines Operating at Universities

Subsidiary of Caterpillar Inc. since 1981
ADVANCED MANUFACTURING CHALLENGES & OPPORTUNITIES

Meet Drawing and Design Requirements

Quality

Procurement
Time

Cost
QUALITY ISSUES

• Non Compliance
• Material Property Consistency
• Inspection Challenges
  – Coatings
  – Welding & Bonding
  – Remanufacturing & Repair
• Advanced Manufacturing Solutions
  – New Inspection Technology
DESIGN & DRAWING REQUIREMENT COMPLIANCE

- Dimensional
  - More Complex Geometries
  - Tight Tolerance Features
  - Coating Thickness
- Material & Coating Properties
- Post Manufacturing Treatment
- Advanced Manufacturing Solutions
  - Additive Manufacturing
PROCUREMENT TIME ISSUES

• Shorter
  – Material Qualification
  – Manufacturing
  – Inspection
  – Non-Compliance

• Advanced Manufacturing Solutions
  – Lean Production
  – Multi-Process Manufacturing Machines

Six Axis Robotic Laser Welder
COST CHALLENGES

• Direct Cost
  – Material
  – Time to Machine, Cast or Form
    • Design Complexity
  – Inspection
  – Non Compliance

• Indirect Cost
  – Tooling Requirements
  – Special Equipment
  – Manufacturing Investment

• Advanced Manufacturing Solutions
  – Advanced Machining Centers
  – Improved Laser Technology
  – Metal Injection Molding

Laser Percussion Drilling

Advanced 5 Axis Machining Center
ADVANCED MANUFACTURING OPPORTUNITIES

• Additive Manufacturing
• New Bonding
• Laser Technology
• Metal Injection Molding
• New Inspection Technology

Universities

DOE & Natl Labs

Suppliers

Solar Turbines
ADDITIVE MANUFACTURING

Opportunities
• Faster Development
• Reduced Lead Time
• Lower Cost
• Improved Quality

Challenges
• Material Availability
• Material Qualification Standard
• Powder Variations
• Surface Finish

Solid Model
Additive Fabrication Machine
Finished Part
ADVANCED MANUFACTURING OPPORTUNITIES
- TURBINE COMPONENTS

- Turbine Airfoils
- Combustor Liner
- Rotating Components
- Fuel Injector
- Bearings