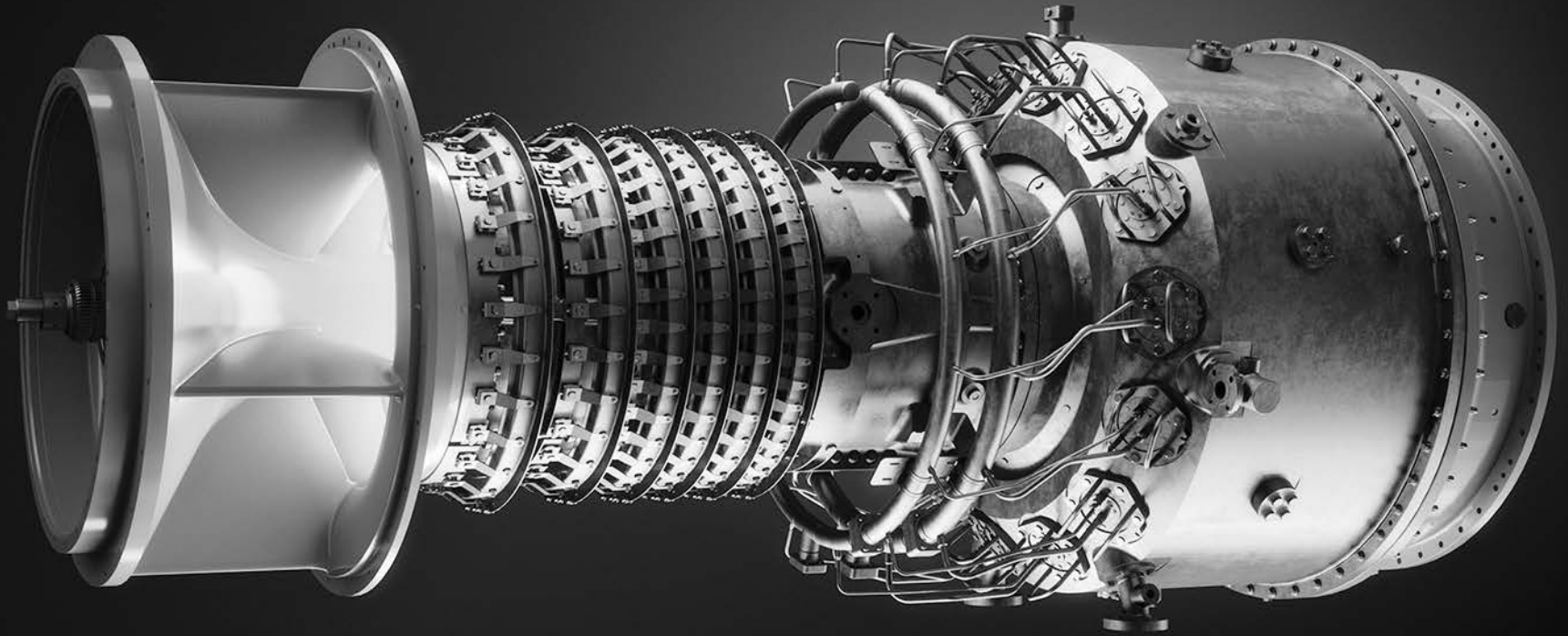


UTSR - ADVANCED MANUFACTURING PANEL



David Teraji

A CULTURE OF CUSTOMER CARE

Solar Turbines

A Caterpillar Company

UTSR – Nov 2015

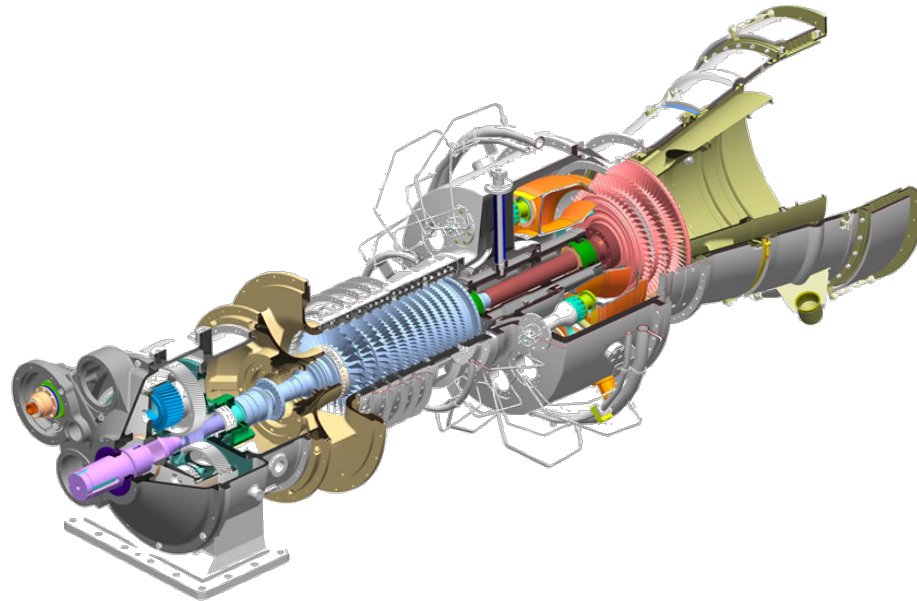
SOLAR TURBINES INCORPORATED

- 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

Quality

**Procurement
Time**



Cost

Meet Drawing and Design Requirements

QUALITY ISSUES

- Non Compliance
- Material Property Consistency
- Inspection Challenges
 - Coatings
 - Welding & Bonding
 - Remanufacturing & Repair
- **Advanced Manufacturing Solutions**
 - **New Inspection Technology**

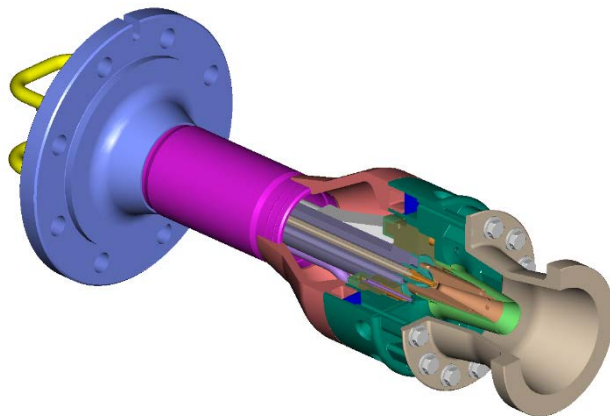
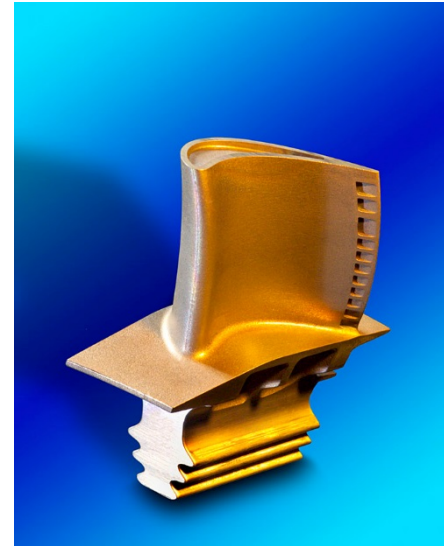


3D Scanning Inspection



DESIGN & DRAWING REQUIREMENT COMPLIANCE

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

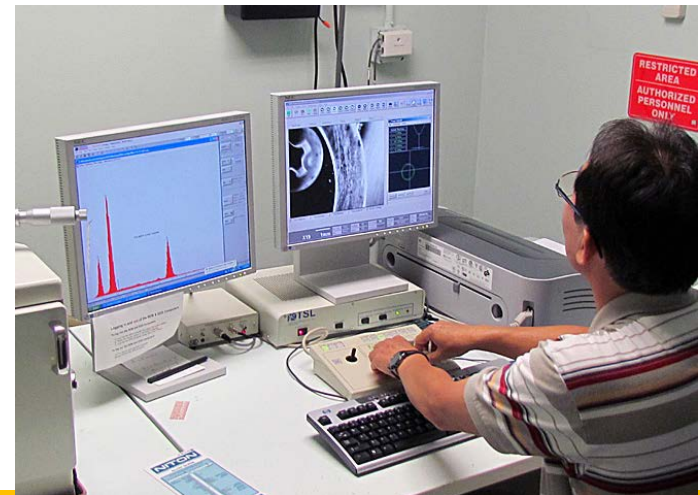
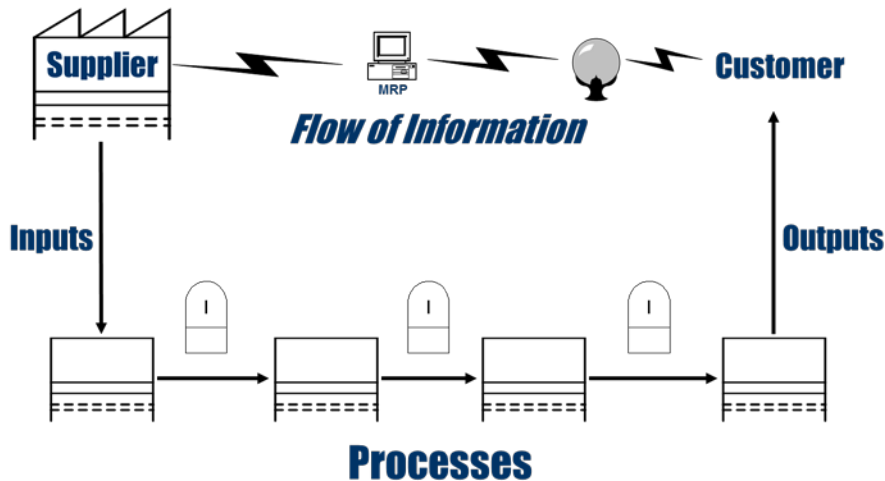


PROCUREMENT TIME ISSUES

- **Shorter**
 - Material Qualification
 - Manufacturing
 - Inspection
 - Non-Compliance
- **Advanced Manufacturing Solutions**
 - Lean Production
 - Multi-Process Manufacturing Machines



Six Axis Robotic Laser Welder

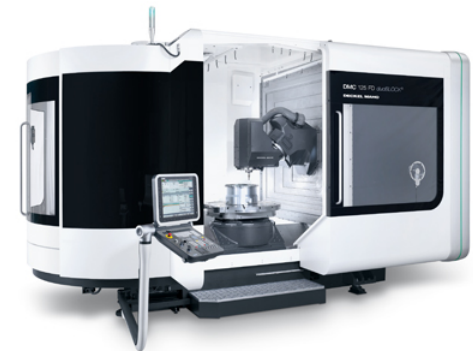


COST CHALLENGES

- **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

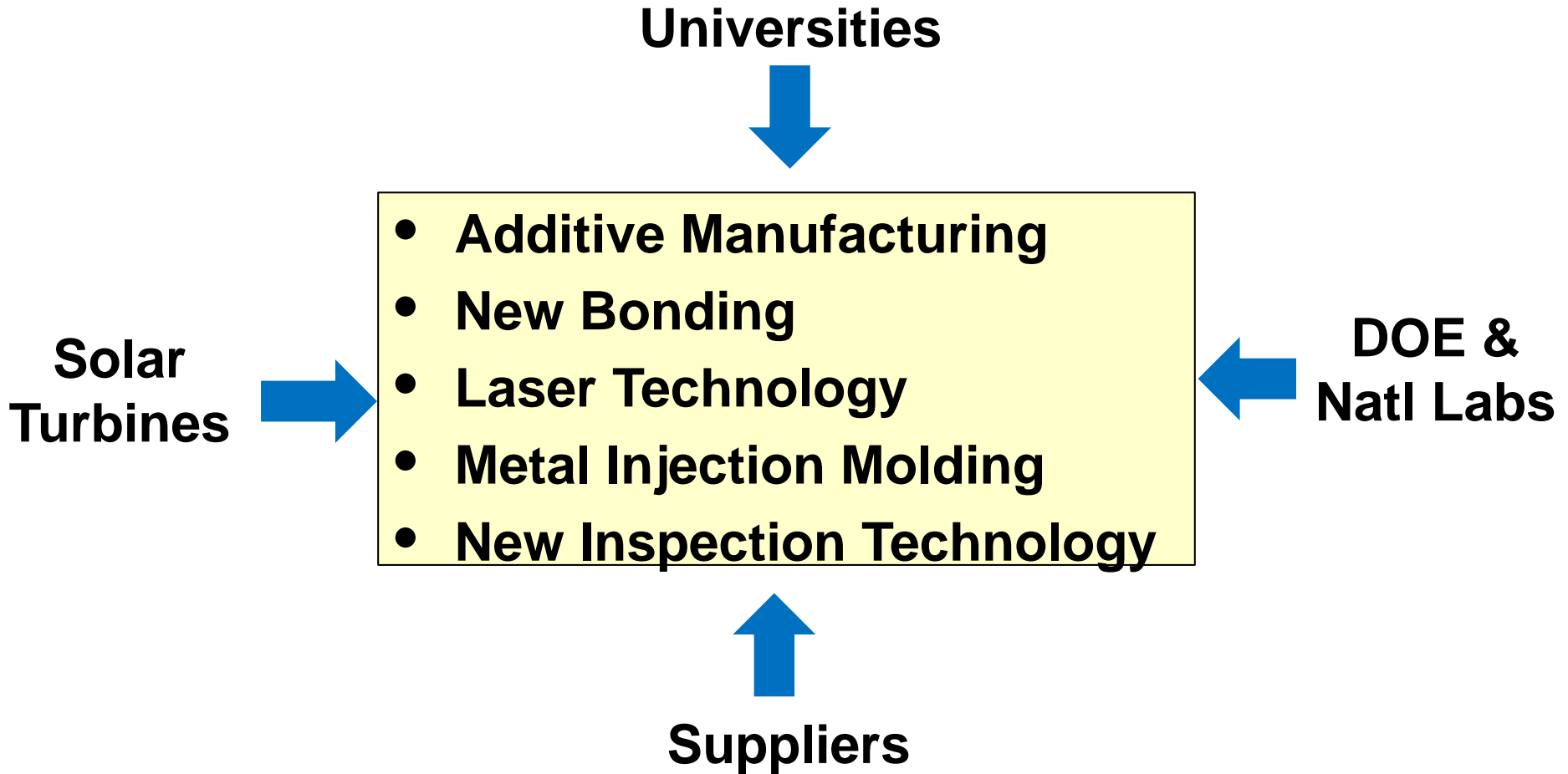


Laser Percussion Drilling



Advanced 5 Axis
Machining Center

ADVANCED MANUFACTURING OPPORTUNITIES



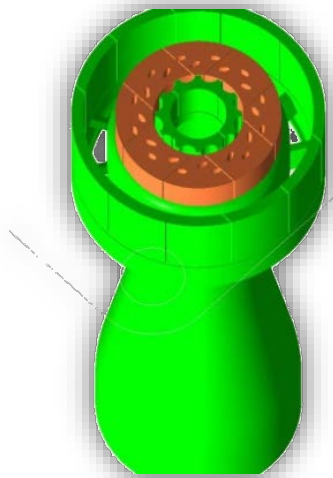
ADDITIVE MANUFACTURING

Opportunities

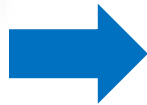
- Faster Development
- Reduced Lead Time
- Lower Cost
- Improved Quality

Challenges

- Material Availability
- Material Qualification Standard
- Powder Variations
- Surface Finish



Solid Model



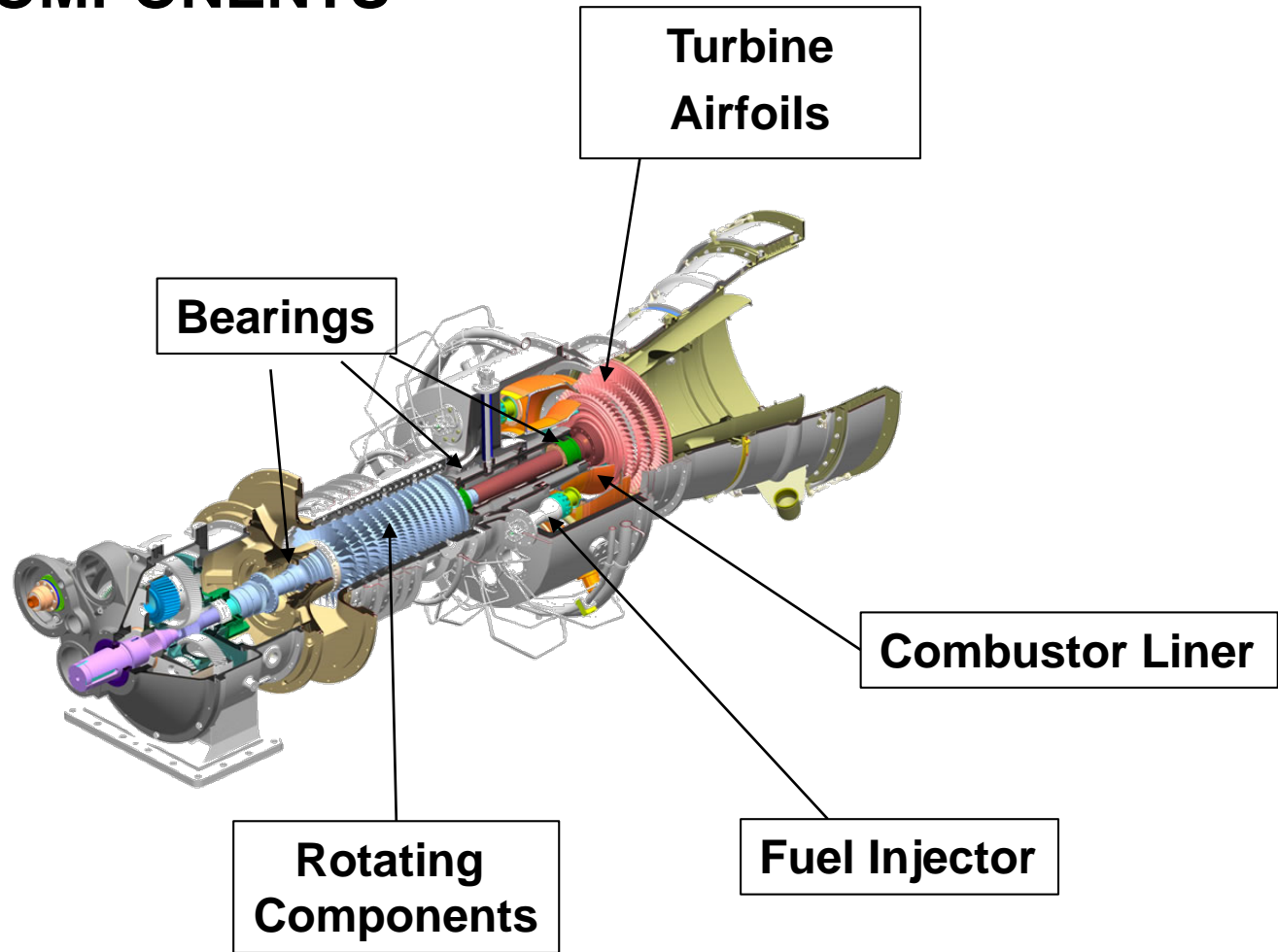
Additive Fabrication Machine



Finished Part

ADVANCED MANUFACTURING OPPORTUNITIES

- TURBINE COMPONENTS



Solar[®] Turbines

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