

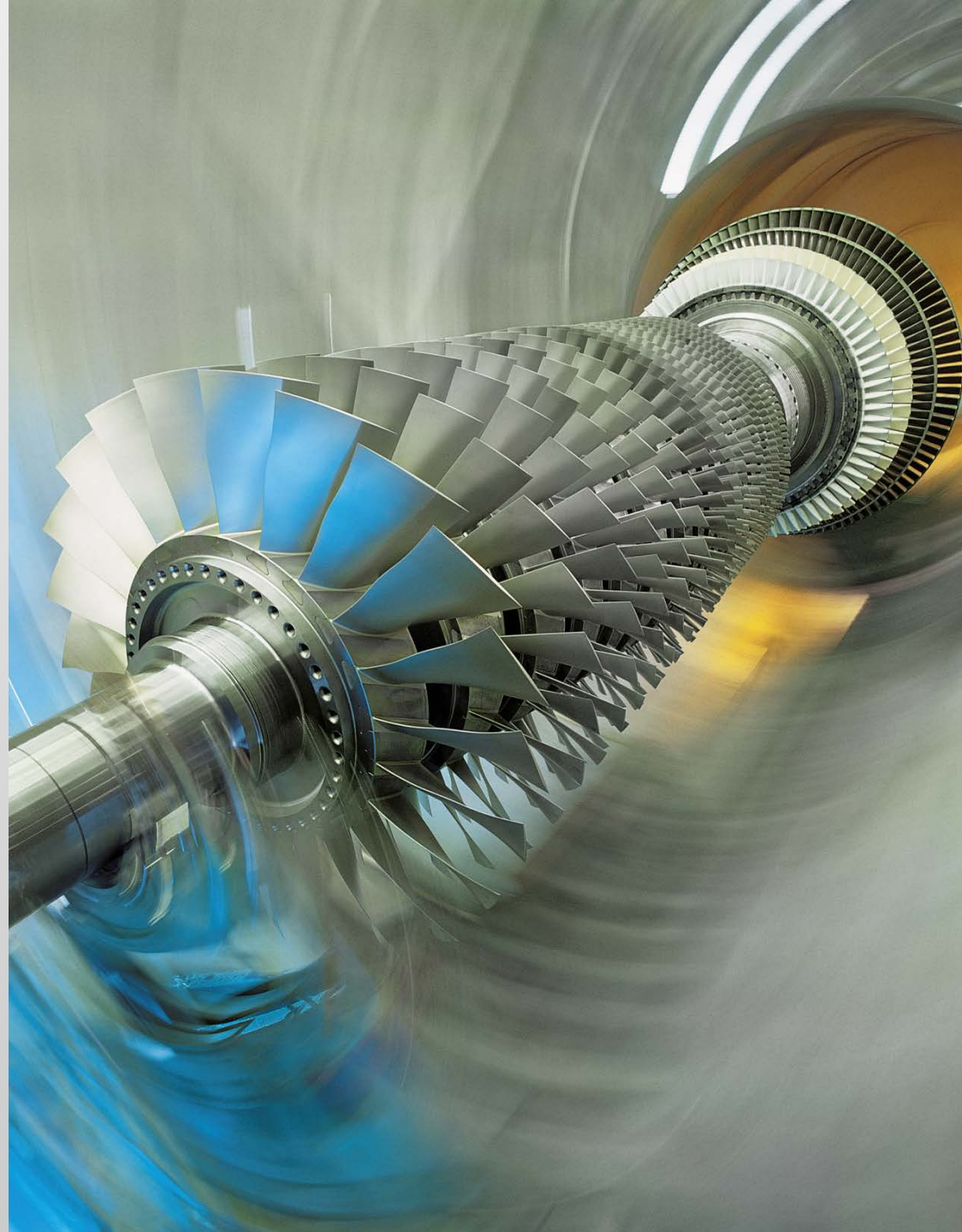


# The UTSR Gas Turbine Industrial Fellowship Program

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Leonardo Technologies, Inc.  
Contractor for the US  
Department of Energy /  
NETL

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# Acknowledgement

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# Fellowship Program Description (1/2)

- **Provides undergraduate and graduate-level engineering students with the opportunity to work at leading gas turbine industry sponsoring companies**
- **Provides the sponsoring companies an opportunity to recruit technical talent from a highly selective pool of applicants**

## Fellowship Program Description (2/2)

- **Fellows spend 10-12 weeks over a summer working at a sponsoring company**
- **Fellows get a lump sum stipend of \$11,500 (undergraduates) or \$13,500 (graduates)**
- **Companies pay the stipends**
  - OEMs pay \$25,000 per year and get 2 Fellows
  - Non-OEMs pay \$12,500 and get one Fellow
  - Member companies can hire additional Fellows from the applicant pool, and they will also be part of the Program.

# Typical Work Areas at Companies

- **Heat transfer**
- **Aerodynamics**
- **Combustion**
- **Thermodynamics**
- **Advanced materials and coatings**
- **Design**
- **Manufacturing**
- **Test and evaluation**

# Eligibility

- **Must have a GPA of at least 3.0**
- **Must be US citizens or green card holders**
- **Undergraduates must complete their Junior year by June of the year that they work at the company**

# Selection Process

- **Applicants provide transcript, letters of recommendation from faculty, description of technical area of most interest and list of companies they most want to work for**
- **Companies provide rank order of preferred applicants**
- **Offers are made for best match of company choices and applicants' choices**

# Benefits to the Fellows

- **Work experience in the gas turbine industry is an advantage in seeking jobs after graduation – in industry or academia**
- **Work experience helps them decide which fields they like best within the GT industry**
- **Practical knowledge gained helps make their remaining academic work more relevant**



## Benefits to Companies (1/2)

- **Host student Fellows proportional to dues level – Assess some of the best students in the nation for future employment as they work on real world problems**
- **The students have been encouraged by their professors to apply and are interested in the gas turbine industry; an advantage in recruiting future employees**

## Benefits to Companies (2/2)

- **Historically, 80% of the UTSR Fellows benefit the gas turbine industry**
  - 70% of them accept jobs with companies in the gas turbine industry
  - Another 10% stay in academia, teaching and researching on gas turbine topics

# Status of the Fellowship Program (1/2)

- **Since the fall of 2010, Southwest Research Institute is implementing the program for NETL, with oversight from LTI, site support contractor for NETL.**
- **2013 Fellowship Program data:**
  - 53 Eligible applicants
  - Made 11 offers to fill the 9 slots (82% acceptance)
  - 9 Fellows selected (17% of eligible applicants)
  - 8 Universities
  - 6 Host Companies

# Status of the Fellowship Program (2/2)

- **2014 Fellowship Program data:**
  - 42 Eligible applicants
  - Made 10 offers to fill the 9 slots (90% acceptance)
  - 9 Fellows selected (21% of eligible applicants)
  - 7 Universities
  - 6 Host Companies

# Fellowship Host Companies 2013 / 2014

- **GE**
- **Siemens**
- **Solar Turbines**
- **FlexEnergy**
- **Woodward Governor**
- **Florida Turbine Technologies**

# 2013 Fellows (1/2)

Fellow	University	Company
Potts, Goeffrey	St. Louis U.	Solar Turbines
Stinson, Matthew	U. Of Minnesota	Solar Turbines
Weston, David	Brigham Young U.	GE
Luo, Kevin	West Virginia U.	GE
Meadows, Joseph	U. Of Alabama	Siemens

## 2013 Fellows (2/2)

Fellow	University	Company
Fabozzi, Eric	West Virginia U.	Siemens
Long, Jonathan	U. of North Dakota	Florida Turbine Technologies
Trofa, Adam	Cornell U.	FlexEnergy
Hayes, Shelby	U. Of Wyoming	Woodward Governor Company

# Examples of Fellows' 2013 Projects

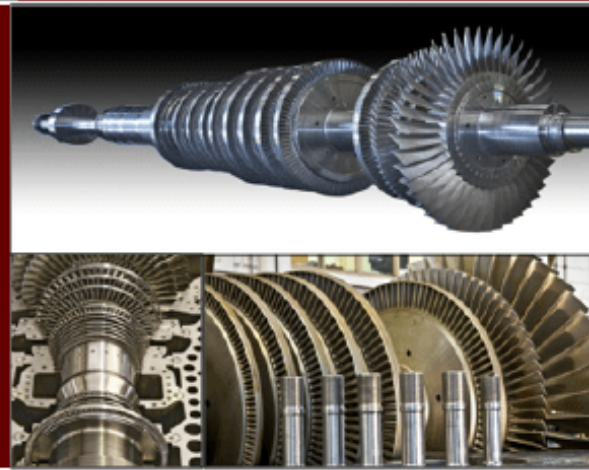
- **Fellows are required to write a report and a PowerPoint presentation on their projects, which are posted on the UTSR Fellowship website [www.swri.org/UTSR](http://www.swri.org/UTSR)**
- **Following are the titles and conclusions charts from three of the presentations that were planned for the 2013 program.**
- **You can see all of the 2013 and earlier Fellows' presentations on the website.**



# Woodward



## 2013 UTSR Fellowship



**August 7, 2013**

**Shelby Hayes**

**Industrial Turbomachinery Systems**

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# Woodward

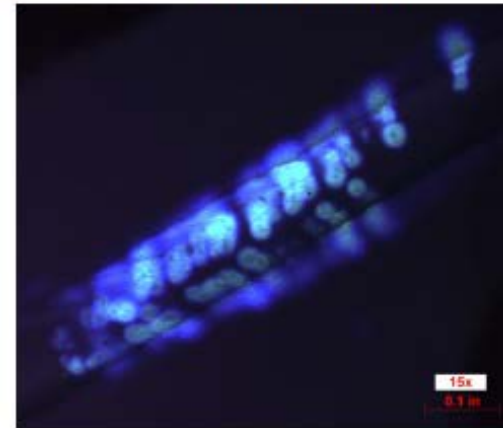
## Primary Summer Projects

UNS N08020 Research  
and Weld Trials



Spray Angle  
Characterization

EB Weld  
Development



Industrial Turbomachinery Systems

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# Woodward

## Skills and Lessons Learned

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- **Company Methods**
  - Six Sigma
  - Culture into Action
- **NPI Processes**
  - Assemblies
  - **Quality Inspections**
  - **Braze Processes**
  - Pressure Testing
  - Lathe
  - SMD Testing
  - Laser Marker
- **Production Processes**
  - EB Welding
  - FPI
  - CMM
  - Flow Test
  - **Collar Press Fit**
- **Customer and Supplier Interaction**
  - GE Tour
  - Phone and Email Correspondence
  - **M&P Face-to-Face**
- **Welding**
  - TIG
  - Laser Tacking
  - Spot/Resistance Tacking
  - Microscope Inspection
- **Project Management**
  - Wedding Planning/Delegation Proficiency

# University Turbines Systems Research Fellowship 2013

**GE Power & Water**

Presenter: Kevin Luo

Coatings & NDE Development  
Manager: Kathleen Morey  
Mentor: Joshua Margolies



imagination at work



# Project 1

## Microstructure and Property Comparisons for AG1 Ceramic Coatings



# Conclusion

In terms of the powder comparison, the St-Gobain AG1 9237 powder produces a better ceramic top coat than the Sulzer Metco SPM 2000-1. The tensile strength is higher on the AG1 9237 coatings sprayed with either parameters or on top of either bond coat. In terms of metallography, the 9237 coatings also holds a distinct advantage in terms of having more vertical cracks per linear inch and having a better resistance to horizontal cracks.

For parameters, the repair TGTS parameter sprayed better top coat. TGTS has a distinct advantage over the GVL OEM in the tensile results and the horizontal crack length nonconformity.

Powder		
	St-Gobain AG1 9237	Sulzer Metco SPM 2000-1
Deposit Efficiency	-	-
Tensile	✓	
Horizontal Crack Length	✓	
Vertical Cracks per Inch	✓	
Parameter		
	GVLOEM	TGTS
Tensile		✓
Horizontal Crack Length		✓
Vertical Cracks per Inch	✓	
Bond Coat		
	GT-21	GT-33
Tensile		✓

Further investigation should be done to examine the observed low deposit efficiency and for the 9237 its appearance of higher porosity. Examining an additional lot for each powder could verify the findings of this project and could initiate a services implementation plan to use the better powder and parameter.



**Solar Turbines**

*A Caterpillar Company*

# Solar Turbines Internship Exit Presentation

**Geoffrey Potts**

Heat Transfer  
Aero/Thermal & Performance

Mentor: Yong Kim  
Supervisor: Hee-Koo Moon  
Manager: John Mason



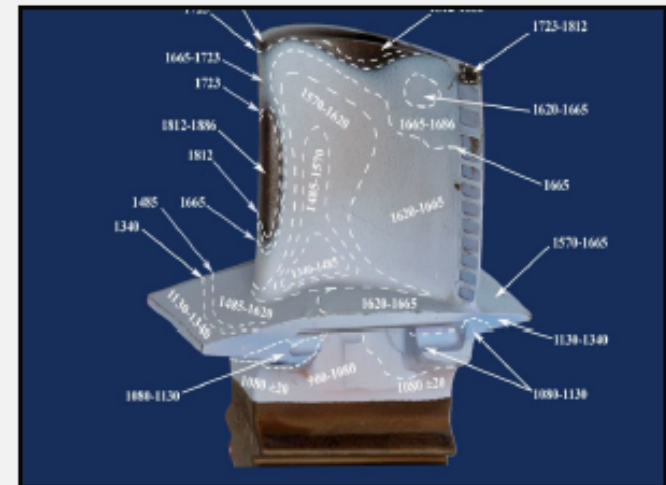
# Solar Turbines

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## Turbine Blade Thermal Imaging

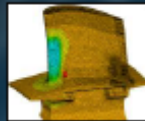
- **Background**
  - An early thermal paint test showed high temperatures on the leading edge of the turbine blade
  - Design team moved to address durability concerns in certain parts of the turbine





# Solar Turbines

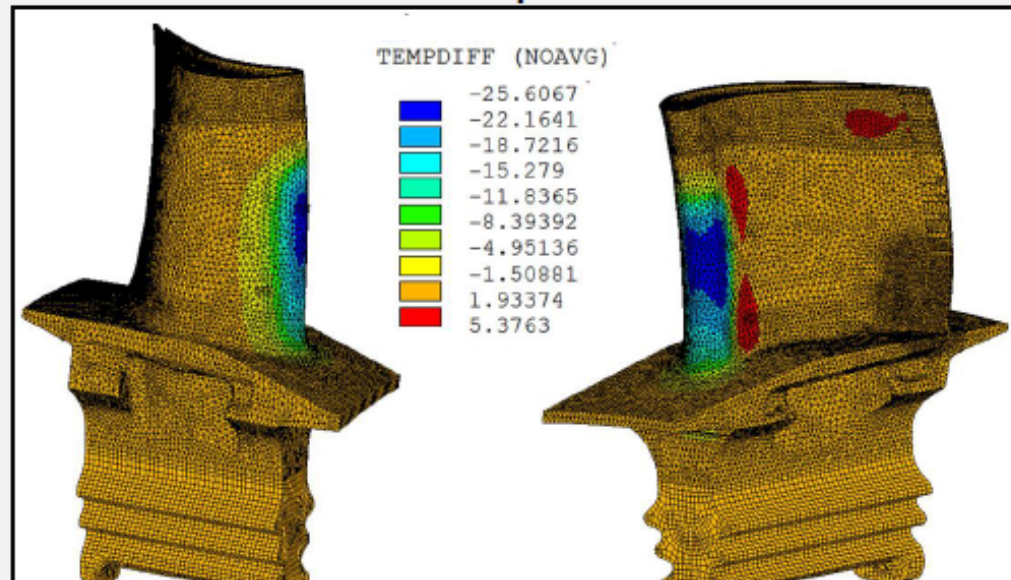
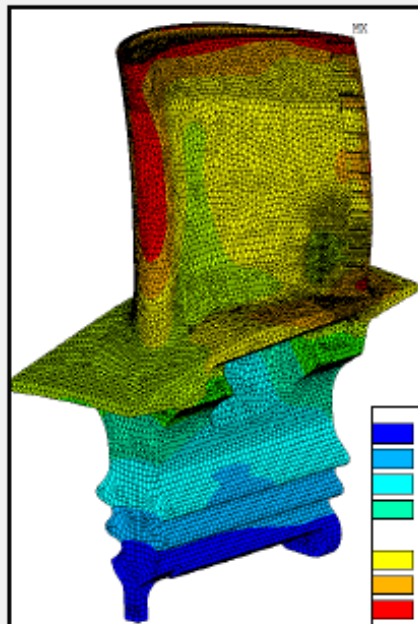
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## Thermal Imaging ANSYS Application

### Comparison

#### New Model



#### Recommendation

- It is acceptable to widen swirl cool slots as long as the radial trip strip is added

#### Benefits

- Save time in the manufacturing of the blade
- Save cost because the core die does not need to be replaced as frequently
- Keeps the blade below oxidation temperature

# 2014 Fellows (1/2)

Fellow	University	Company
Alieninov, Phillip	University of Florida	Solar Turbines
Bollinger, Andrea	University of Florida	Siemens
Ciha, Kevin	University of Minnesota	Florida Turbine Technologies
Cranney, James Alexander	Brigham Young University	Flex Energy
D'Imperio, Mark	Pennsylvania State University	Siemens

## 2014 Fellows (2/2)

Fellow	University	Company
Gates, Samuel	University of Wyoming	Woodward Governor Company
Mullenix, Lindsay	Clemson University	GE
O'Meara, Bridget	Pennsylvania State University	Solar Turbines
Tuesta, Alfredo	Purdue University	GE

## Summary

**The UTSR Fellowship Program is providing valuable experience for the Fellows and a source of trained engineers for the gas turbine industry.**