

March 2020

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ACADEMIC PREPARATION

B. S.	1982	Mechanical Engineering, University of Illinois, Urbana-Champaign
M. S.	1984	Mechanical Engineering, University of Illinois, Urbana-Champaign
Ph.D.	1992	Mechanical Engineering, University of Texas, Austin

PROFESSIONAL EXPERIENCE

The Pennsylvania State University (Penn State)

Department of Mechanical Engineering

January 2017 – present, University Distinguished Professor and Department Head

August 2006 – present, Professor and Department Head

Research (directed funded research projects in excess of \$36M):

- Convective Heat Transfer Studies – Funding support: Department of Energy, ARPA-E, National Science Foundation, Siemens Energy, Mitsubishi Heavy Industries, IHI (Japan), United Technologies Research Center, and United Technologies-Pratt & Whitney's Center of Excellence, Federal Aviation Administration, NASA, Solar Turbines

Teaching:

- Ph.D. and M.S. Research, graduate level advising
- Senior Thesis for B.S. Honors Students (ME 494H)
- First Year Seminar on Toy Fundamentals (ME 101s)
- First Year Seminar on Smart Lego Robots and Design (ME 102s)

Virginia Polytechnic Institute and State University (Virginia Tech)

Mechanical Engineering Department

July 2004 – June 2006, Assistant Department Head for Research

July 2005 – June 2006, William S. Cross Professor of Mechanical Engineering

July 2003 – June 2006, Professor, Mechanical Engineering Department

April 2002 – June 2006, Director, Center for Turbomachinery and Propulsion

July 2001 – June 2003, Associate Professor

January 1999 – June 2001, Assistant Professor

Research:

- Convective Heat Transfer Studies – Funding support: Department of Energy, the National Science Foundation, Siemens Energy, and United Technologies-Pratt & Whitney
- Thermal analyses of Integrated Circuits – Financial support from the National Science Foundation Engineering Research Center on Power Electronics

Teaching:

- Ph.D. and M.S. Research, graduate level course (ME 5994 and 7994)
- Turbulence and Turbulent Flows (ESM 5554)
- Boundary Layer Theory (AOE 5114)
- Fluid Mechanics (ME 3404)
- Senior Capstone Design (ME 4015 and ME 4016)

University of Wisconsin-Madison

Mechanical Engineering Department

November 1994 – December 1998, Assistant Professor

Research:

- Experimental and Numerical Studies in Freestream Turbulence Effects – Funding support: National Science Foundation CAREER Award and the Department of Energy
- Experimental and Numerical Studies of Endwall Vortical Flows with the Development of a Fillet– Funding support from United Technologies-Pratt & Whitney
- Flowfield Measurements Along Louvered Fin Heat Exchangers – Funding support from Modine Manufacturing

Teaching:

- Ph.D. and M.S. Research, graduate level course (ME 790 and ME 890)
- Convective Heat Transfer (ME 765)
- Fluid Mechanics (ME 363)
- Heat Transfer (ME 364)
- Freshman Design (EPD 160)

Karlsruhe Institute of Technology, Karlsruhe Germany

Institute for Thermal Turbomachinery

January 1993 – November 1994, Post-Doctoral Research Associate

Research:

- Design and development of a transonic film-cooling facility
- Flowfield measurements of a film-cooled, turbulent boundary layer– Funding support from the BRITE-EURAM Program

University of Texas

Mechanical Engineering Department

January 1988 – December 1992, Research Assistant

June 1989 – August 1989 Teaching (Assistant Instructor): Fluid Mechanics (ME 330)

Lawrence Livermore National Laboratory

Nuclear Test and Engineering Division

September 1984 – December 1988, Research Engineer

University of Illinois at Urbana-Champaign

Department of Mechanical Engineering

August 1982 - August 1984 Research and Teaching Assistant

HONORS AND AWARDS

AIAA Air Breathing Propulsion Award, 2019
AIAA Associate Fellow, 2018
ABET Claire L. Felbinger Diversity Award, 2017
53rd AIAA/SAE/ASME Joint Propulsion Conference Best Paper Award, 2017
University Distinguished Professor, Penn State, 2017
ASME Edwin F. Church Medal for Engineering Education, 2016
College of Engineering's Distinguished Service Alumni Award, University of Illinois, 2016
ASME George Westinghouse Gold Medal, 2015
ASME Distinguished Service Award, 2015
Howard B. Palmer Faculty Mentoring Award, Penn State, 2015
Society of Women Engineers Distinguished Engineering Educator Award, 2014
Distinguished Alumnae in Mechanical Science and Engineering, University of Illinois, 2013
Rosemary Schraer Mentoring Award, Penn State, 2012
U. S. White House *Champion of Change* in Science, Technology, Engineering, and Math, 2011
Best Heat Transfer Paper, ASME's International Gas Turbine Institute, 2005, 2009, 2013, 2016
Top 10 cited papers from 2005-2010 in the *International Journal of Heat and Fluid Flow*
ASME Distinguished Service Award, 2008
William S. Cross Professorship, Virginia Tech, 2005-06
ASME Fellow, 2004
Distinguished Alumnae in Mechanical Engineering, University of Texas, 2004
College of Engineering Faculty Fellow, Virginia Tech, 2003-2006
AdvanceVT Professorship, Virginia Tech, 2003-2006
Power Generation Distinguished Lecturer, Siemens, 2002 and 2004
Ingersoll-Rand Faculty Award, Virginia Tech, 2001
W. M. Rohsenow Best Presentation for Gas Turbine Heat Transfer, ASME, 1997, 2005, 2009
CAREER Award, National Science Foundation, 1996
Non-tenured Faculty Grant, 3M, 1996, 1997, 1998
University of Wisconsin Chancellor's Faculty Recruitment Award, 1994

RESEARCH EXPERTISE

Convective heat transfer taking theory to application in developing new cooling designs for harsh, high temperature environments that lead to increases in energy efficiency in power producing energy systems. Setting up unique experimental facilities that address needed predictive methods for convective heat transfer and pressure loss in various cooling methods. Using additive manufacturing and computational optimization methods to develop new, complex cooling strategies that are not possible with traditional manufacturing.

EDUCATIONAL LEADERSHIP

Department Head, Mechanical Engineering Department, 2006-present*

- Led a major curriculum change to modernize the Bachelors of Science in Mechanical Engineering degree at Penn State. Features of the new curriculum included: i) an emphasis on computations and mechatronics; ii) a new laboratory course emphasizing systems with modern topics such as big data, renewable energy, autonomous systems, and other such topics; and iii) a two-part course for one credit that includes career planning, business principles for engineers, ethics and several other topics of importance for skill development.

- Developed and offered the first micro-credentialing workshops in the College of Engineering to enhance students' skills identified by companies to include topics such as geometric tolerancing, project management, value engineering, introduction to machine learning, and others. These workshops, taught by instructors from industry, are between four and eight hours. Students' proficiency is assessed at the end of the workshop and a badge is presented if assessment is positive. (<https://www.asee.org/documents/publications/prism/PrismMarApr2019.pdf>)
- Led and instituted global team projects for the mechanical engineering capstone course. Developed numerous global partnerships to carry out these projects involving students from Penn State and another international university partner to address an industry-proposed problem.
- Led the development and offering of an on-line Master of Science in Mechanical Engineering. Program approved by the Graduate School (first M.S. program at Penn State to be offered on-line). Program now has over 100 students enrolled.
- Led the development and offering of an on-line and resident Master of Engineering in Additive Manufacturing and Design, which was the first in the U.S., involving five departments and two Colleges at Penn State. Program now has over 90 students enrolled.
- Co-founder of the Engineering Ambassador Program at Penn State and the Engineering Ambassador Network involving over 15 institutions. This program is a professional development program teaching communication and leadership to our college students with an outreach mission to local high schools. Using the National Academy of Engineering's *Changing the Conversation* messages, Engineering Ambassadors communicate the excitement of engineering to high school students. The national effort has been funded through the National Science Foundation.

* prior to July 2019, Department Head of Mechanical and Nuclear Engineering

SIGNIFICANT SERVICE TO THE PROFESSION

- National Academies of Sciences, Engineering, Medicine's Gas Turbine Development Study Committee, Member, 2018-2019
- ASME Board of Governor Member, 2018-present
- NASA Advisory Council, Aeronautics Committee, 2013-present
- National Science Foundation's Committee of Visitors for Engineering Education Division, 2016
- National Academies of Sciences, Engineering, Medicine's Low Carbon Aviation Study Committee, Co-Chair, 2015-2016
- ASME Energy Conversion and Storage Segment, Leader and Member, 2014-2016
- Program reviewer for Mechanical Engineering Departments at Texas A&M University (2020), University of Texas-Dallas (2019), Carnegie-Mellon (2019), University of Colorado (2018), University of Florida (2017), Iowa State University (2016), Purdue University (2015), and University of Minnesota (2014)
- ASME Committee on Honors, Member from 2009-10; Chair from 2010-14
- Board of Directors for the International Gas Turbine Institute, Member, 2009-12; Vice Chair, 2012-13; Chair 2013-14; and Special Advisor to the Chair, 2016-17
- ASME Mechanical Engineering Department Head Executive Council, Member for 2006, Secretary from 2007-2009, Vice Chair from 2010-2012; Chair from 2012-13
- ASME Vision 2030 Committee (ME curriculum reform), Member, 2008-2011
- ASME Knowledge and Communities Re-organization Task Force, 2013-14
- ASME Center for Education Board of Directors, 2010-2014

DEPARTMENT FUNDRAISING

- \$7M gift to name the Nuclear Engineering Program
- \$3M gift for ME Chair and excellence fund
- \$2M unrestricted gift from ME alumni
- \$450K gift for the E-Knowledge Commons
- \$750K endowed scholarship/fellowship gift for ME / \$175K endowed scholarship/fellowship gift for NucE
- Lee Everett Professorship
- \$250K for ME graduate fellowships from an alum
- \$100K gift for endowing the Hochreiter Distinguished Seminar Series
- Four Early Career Professorships: Kenneth K. and Olivia Kuo Early Career Professorship; Kenneth Kuan-Yun Kuo Early Career Professorship; Clyde Shuman Early Career Professorship; Martin W. Trethewey Early Career Professorship
- \$2M gift from Toshiba-Westinghouse
- \$350K gift from United Technologies for the Engineering Ambassadors
- \$11K/year for MNE Innovation Competition and recognition of an ME Junior
- \$125K from Volvo for an early faculty development funds
- \$125K from five corporations to fund the E-Knowledge Commons group meeting rooms.

INVITED LECTURES AND KEYNOTE PRESENTATIONS (Last eight years)

New Frontiers of Thermal Transport, invited speaker, National Science Foundation Workshop, University of Central Florida, 2020

Additive Manufacturing Effects on Turbine Cooling, University of Houston, February 2020

Additive Manufacturing Effects on Turbine Cooling, Clemson University, February 2020

Development of a National Experimental Turbine (NExT), invited speaker, 13th Operational Energy Summit, Washington DC, January 2020

Advanced Technologies for Gas Turbines, AIAA SciTech Panel, January 2020

Using Additive Manufacturing to Advance Convective Cooling Designs, invited keynote seminar for the ASME International Mechanical Engineering Conference, November 2019

University-Industry-Academia Collaboration to Develop the National Experimental Turbine (NExT), invited keynote at DOE's University Turbine Systems Research Program Workshop, November 2019

Advanced Technologies for Gas Turbines, National Academies of Sciences, Engineering, and Medicine' Aeronautics Science and Engineering Board, September, 2019

Additive Manufacturing Effects on Turbine Cooling, Case Western Reserve, September 2019

Effects of Additive Manufacturing on Convective Heat Transfer, invited keynote seminar for the American Society of Thermal and Fluids Engineers Conference, March 2018

Aligning Engineering Education: Opportunities for Collaboration between Universities, Industry, and Professional Societies, National Academies of Sciences, Engineering, and Medicine, December 2018

Additive Manufacturing for Heat Exchange, University of Delaware, September 2018

Additive Manufacturing for Heat Exchange, University of Texas at Dallas, October 2018

Exploiting Additive Manufacturing for Cooling, University of Colorado, January 2018

Exploiting Additive Manufacturing for Cooling, University of Michigan, November 2017

Additive Manufacturing for Turbine Cooling, Oxford University, March 2017

Exploiting Additively Manufactured Microchannels for Heat Exchange, University of Tennessee, Deans Distinguished Seminar Series, January 2017

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, University of Illinois at Urbana-Champaign, October 2016

Commercial Aircraft Propulsion and Energy Systems Research: Reducing Global Emissions, AIAA Forum 360, Propulsion and Energy, Salt Lake City, UT, July 2016

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, Distinguished Seminar, University of Alabama-Huntsville, February 2016

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, Distinguished Seminar, University of Wisconsin-Madison, October 2015

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, Distinguished Seminar, University of Central Florida, September 2015

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, The Pratt & Whitney Distinguished Lecture, University of Connecticut, April 2015

Additive Manufactured Microchannels for Cooling Gas Turbine Airfoils, Colorado State University, April 2015

Blockage Effects on Cylindrical and Shaped Film Cooling Holes, Villanova University, September 2014

Blockage Effects on Cylindrical and Shaped Film Cooling Holes, Texas A&M University, September 2014

Recent Developments in Film Cooling, Siemens Energy, 2013

Impacts of Particle Ingestion on External and Internal Flow Paths, UTC Scholar Lecture, September 2012

Flowfield and Heat Transfer Measurements in Low Aspect Ratio Pin Fin Arrays, Rensselaer Polytechnic Institute, September 2012

Flowfield and Heat Transfer Measurements in Low Aspect Ratio Pin Fin Arrays, Purdue University, August 2012

Simulations of Multi-Phase Particle Deposition on Film-Cooled Turbine Components, Shanghai Jiao Tong University, June 2011

INVITED TECHNICAL BRIEFINGS

- Invited presenter in a US Congressional Briefing on Gas Turbines, April 2019
- Invited presenter in a US Congressional Briefing on Gas Turbines, September 2017
- Invited presenter in a US Congressional Briefing on Gas Turbines, September 2016 (<https://www.asme.org/about-asme/advocacy-government-relations/policy-publications/capitol-update/october-7-2016-capitol-update#1>)

- Invited presenter for the Low Carbon Aviation Report by the National Academies of Sciences, Engineering, and Medicine to the FAA, DOE, USDA, USAF, AIAA, House Subcommittee, Office of Science and Technology, and EPA, Summer 2016
- Invited presenter in a US Congressional Briefing on Digital Manufacturing, May 2016 (http://housemanufacturingcaucus-reed.house.gov/sites/housemanufacturingcaucus.house.gov/files/wysiwyg_uploaded/Briefing%20on%20Digital%20and%20Cyber%20Manufacturing_Final.pdf)
- Invited presenter in a US Congressional Briefing on Gas Turbines, March 2016 (http://gasturbine.org/docs/newdocs/GTA-AGA_Capitol_Hill_Briefing_Flyer_Feb_2016.pdf)
- Invited presenter for ASME to the *Education and Skills for Manufacturing-US Teaching Methods and Course Structures*, Institution of Mechanical Engineers, London England, February 2013

RESEARCH SUPERVISION

Doctoral Student Advisees

- Radomsky, Roger, 2000, *High Freestream Turbulence Studies on a Scaled-Up Stator Vane*, Mechanical Engineering, University of Wisconsin-Madison. (Raytheon)
- Lethander, Andrew, 2003, *Evaluation of a Fillet Design for a First Vane*, Mechanical Engineering, Virginia Tech. (Air Force Research Lab)
- Colban, Will, 2005, *Performance of Shaped Film-Cooling Holes on a Turbine Vane,*” (Recipient of NSF Honorable Mention, Recipient of 2nd Place for the the Paul E. Torgersen Graduate Student PhD Poster for Research Excellence Award) Mechanical Engineering, Virginia Tech. (Amber Kinetics, Director)
- Sewall, Evan, 2005, *Heat Transfer Predictions for Ribbed Surfaces*, co-advised with D. Tafti, Mechanical Engineering, Virginia Tech. (GE Power)
- Barringer, Mike, 2006, *Developing and Testing a Combustor Simulator for Investigating High Pressure Turbine Aerodynamics and Heat Transfer* (recipient of Best Technical Presentation, AIAA 28th Dayton-Cincinnati Aerospace Science Symposium; Recipient of Incentive Award at the Propulsion Directorate, AFRL), Mechanical Engineering, Virginia Tech. (Penn State, Associate Res Prof)
- Sundaram, Narayan, 2007, *Effects of Surface Conditions on Endwall Film-Cooling* (recipient of 2nd Place for the the Paul E. Torgersen Graduate Student PhD Poster for Research Excellence Award; recipient of 2005 Best Heat Transfer Paper at the International Gas Turbine and Aeroengine Congress and Exposition) Mechanical Engineering, Virginia Tech. (Amazon)
- Scrittore, Joe, 2008, *Experimental Study of the Effect of Dilution Jets on Film Cooling Flow in a Gas Turbine Combustor*, Mechanical Engineering, Virginia Tech. (NAVAIR)
- Knost, Daniel, 2008, *Parametric Investigation of the Combustor-Turbine Interface Leakage Geometry*, Mechanical Engineering, Virginia Tech. (Stewart-Haas Racing Crew Chief)
- Cardwell, Nick, 2010, *Investigation of Particle Trajectories for Wall Bounded Turbulent Two-Phase Flows*, co-advised with P. Vlachos (recipient of 2005 Best Heat Transfer Paper at the International Gas Turbine and Aeroengine Congress and Exposition), Mechanical Engineering, Virginia Tech. (Bractlet, Vice Pres of Operations)

- Lawson, Seth, 2011, *Simulating Particle Deposition from Coal-Derived Fuels*, (recipient of IGTI Travel Award, 2009 Best Heat Transfer Paper at the International Gas Turbine and Aeroengine Congress and Exposition) Mechanical Engineering, Penn State. (Department of Energy-NETL, Program Manager)
- Lynch, Steve, 2011, *The Effect of Endwall Contouring on Boundary Layer Development in a Turbine Blade Passage*, (recipient 2005, 2006, 2007 Virginia Space Grant Fellowship, Wilbur Wright Fellowship, 2006 Gordan C. Oates Graduate Award, and 2009 Warren M. Rosenhow Best IMECE Heat Transfer Presentation), Mechanical Engineering, Virginia Tech. (Penn State, Associate Professor)
- Thrift, Alan, 2011, *Contour Effects on Secondary Flows*, Mechanical Engineering, Penn State. (Siemens Energy)
- Ostaneck, Jason, 2012, *Flowfield Interactions in Low Aspect Pin Fin Arrays* (recipient of a fellowship from the Science, Mathematics and Research for Transformation-SMART Program) Mechanical Engineering, Penn State. (Purdue Polytechnic, Assistant Professor)
- Mensch, Amy, 2015, *Using Conjugate Heat Transfer Analyses to Assess the Cooling Performance on a Turbine Endwall* (recipient of the Alan Brockett Penn State-Pratt & Whitney Graduate Award, College of Engineering Distinguished Teaching Fellow) Mechanical Engineering, Penn State. (National Institute of Standards and Technology)
- Schroeder, Robert, 2015, *High Density Ratio Film-Cooling Studies*, Mechanical Engineering, Penn State (recipient of a three year fellowship from the NASA Aeronautics Scholarship Program). (Sargent-Lundy)
- Gibson, Jeffrey, 2015, *Deposition Effects on Turbine Endwalls* (recipient of a one year University Graduate Fellowship and Graduate Teaching Fellowship) Mechanical Engineering, Penn State. (Siemens Energy)
- Clark, Ken, 2016, *Sealing Effectiveness of a Turbine Rim Seal at Engine-Relevant Conditions*, 2016 (recipient of a three year National Defense Science and Engineering Graduate Fellowship) Mechanical Engineering, Penn State. (Pratt & Whitney)
- Stimpson, Curtis, *MicroChannel Cooling through the Uses of Additive Manufacturing*, (recipient of a one year University Graduate Fellowship; 2017 PSU Alumni Dissertation Award—only two given in the College of Engineering) Mechanical Engineering, Penn State. (Honeywell)
- Kirsch, Katie, 2017, *Optimized Microchannel Cooling Made Possible through Additive Manufacturing* (recipient of a National Science Foundation Graduate Fellowship; Alan Brockett Award; and AIAA/SAE/ASME Joint Propulsion Conference Best Paper Award, ASME Heat Transfer Best Paper Award) Mechanical Engineering, Penn State. (United Technologies Research Center)
- Snyder, Jacob, 2019, *Improving Turbine Cooling through Control of Surface Roughness in the Additive Manufacturing Process*, (AIAA/SAE/ASME Joint Propulsion Conference Best Paper Award, recipient of the 2019 PSU Alumni Dissertation Award) Mechanical Engineering, Penn State. (Pratt & Whitney)

Current Doctoral Advisees

- Corbett, Thomas, Heat Transfer using 3D Printed Structures
- Siroka, Shawn, Mechanical Engineering, Penn State.
- Knisely, Brian, Mechanical Engineering, Penn State.

Monge-Concepcion, Ivan, Mechanical Engineering, Penn State.
Deshong, Eric, Mechanical Engineering, Penn State.
Veley, Emma, Mechanical Engineering, Penn State
Wildgoose, Alexander, Mechanical Engineering, Penn State
Wilkins, Peter, Mechanical Engineering, Penn State

Masters of Science Advisees

Bangert, Boris, 1996, *Development and Testing of a Scaled-up Turbine Vane Cascade*, Mechanical Engineering, University of Wisconsin.

Martin, Cheryl, K. A., 1997, *Leading Edge Film Cooling Conceptual Design Through CFD*, Mechanical Engineering, University of Wisconsin.

Springer, Marlow, 1998, *Flowfield Studies in Louvered Fins Relevant to Compact Heat Exchangers*, Mechanical Engineering, University of Wisconsin. (Nominated by the Mechanical Engineering Department as the best thesis in 1998).

Kang, Brian, 1998, *Detailed Measurements in the Endwall Region of a Gas Turbine Stator Vane*, Mechanical Engineering, University of Wisconsin.

Hermanson, Kristina, 1999, *Effect of Inlet Conditions on Endwall Secondary Flows*, Mechanical Engineering, University of Wisconsin.

Zess, Gary, 1999, *Methods to Reduce the Leading Edge Horseshoe Vortex in a Gas Turbine Stator Vane*, Mechanical Engineering, University of Wisconsin.

Lemmon, Chris, 2000, *Internal Geometry Effects on Film Cooling*, Mechanical Engineering, University of Wisconsin.

Lyman, Andrew, 2000, *Heat Transfer Measurements in Louvered Fin Arrays*, Mechanical Engineering, Virginia Tech.

Barringer, Michael, 2001, *Heat Transfer and Flowfield Measurements Downstream of a Scaled-Up Combustor*, Mechanical Engineering, Virginia Tech.

Weinberger, Sarah, 2001, *Predictions of the Flowfield and Heat Transfer in a Turbine Vane Test Section Downstream of a Combustor Liner*, Mechanical Engineering, Virginia Tech.

Colban, Will, 2002, *Effects of Realistic Combustor Exit Profiles on Vane Endwall Heat Transfer*, Mechanical Engineering, Virginia Tech (Outstanding Scholar in Mechanical Engineering at Virginia Tech; Honorable Mention for the NSF Graduate Fellowship).

Stephan, Ryan, 2002, *Heat Transfer Measurements Along Louvered Fins*, Mechanical Engineering, Virginia Tech.

Pang, Yingfeng, 2002, *Thermal Analyses of IPEMs*, co-advised with Dr. Elaine Scott, Mechanical Engineering, Virginia Tech.

Sewall, Evan, 2002, *Thermal Analyses of Electronic Components*, Mechanical Engineering Department, Virginia Tech, continued on for a PhD co-advised with Dr. Danesh Tafti.

Vakil, Sachin, 2002, *Flow and Thermal Field Measurements in a Combustor Simulator Relevant to a Gas Turbine Aero-Engine*, Mechanical Engineering, Virginia Tech.

Hohlfeld, Erik, 2003, *Simulations of Blowing for Blade Tip and Hub Cooling*, Mechanical Engineering, Virginia Tech (recipient of FLUENT Best Student Paper, 2003).

- Couch, Eric, 2003, *Adiabatic Effectiveness Measurements for Blade Tip Cooling*, Mechanical Engineering, Virginia Tech.
- Christophel, Jesse, 2003, *Adiabatic Effectiveness Measurements for Blade Hub Cooling*, Mechanical Engineering, Virginia Tech.
- Knost, Daniel, 2003, *Endwall Film-Cooling for a First Vane*, Mechanical Engineering, Virginia Tech.
- Ebeling, Chris, 2003, *Tube Wall Heat Transfer Coefficients for Compact Heat Exchangers*, Mechanical Engineering Department, Virginia Tech.
- Gratton, Andrew, 2003, *Heat Transfer Coefficients on a Contoured Vane*, Mechanical Engineering, Virginia Tech.
- Ranson, William, 2004, *Adiabatic Effectiveness Measurements of Leakage Flows Near the Hub Region of Gas Turbine Engines*, Mechanical Engineering, Virginia Tech.
- Prausa, Jeffrey, 2004, *Heat Transfer Coefficient and Adiabatic Effectiveness Measurements for an Internal Turbine Vane Cooling Feature*, Mechanical Engineering, Virginia Tech.
- Morris, Angela, 2005, *Experimental and Computational Study of a Turbine Blade Tip with a Shelf*, Mechanical Engineering, Virginia Tech (University Turbine Systems Fellowship Recipient).
- Elder, Erin, 2005, *Advance Cooling Concepts*, Mechanical Engineering, Virginia Tech (recipient of a Virginia Space Grant Fellowship).
- Walsh, Scott, 2005, *Effects of Sand Ingestion on the Film-Cooling of Turbine Blades*, Mechanical Engineering, Virginia Tech (University Turbine Systems Fellowship Recipient).
- Sanders, Paul, 2005, *Effects of Louver Length and Vortex Generators to Augment Tube Wall Heat Transfer in Louvered Fin Heat Exchangers*, Mechanical Engineering, Virginia Tech.
- Cardwell, Nick, 2005, *Effects of Gap Leakages on Endwall Film-Cooling*, Mechanical Engineering, Virginia Tech (1st Place Presentation for the Paul E. Torgersen Graduate Student MS Research Excellence Award; University Turbine Systems Fellowship Recipient).
- Brumbaugh, Scott, 2006, *Development of a Methodology to Measure Aerodynamic Forces on Pin Fins in Channel Flow*, Mechanical Engineering, Virginia Tech.
- Lyall, Evan, 2006, *Heat Transfer for Low Aspect Ratio Pin Fins*, Mechanical Engineering, Virginia Tech.
- Lawson, Michael, 2006, *Practical Applications of Delta Winglets in Compact Heat Exchangers with Louvered Fins*, Mechanical Engineering, Virginia Tech.
- Land, Cam, 2006, *Effects of Sand Ingestion on the Cooling of Turbine Blade Outer Air Seals*, Mechanical Engineering, Virginia Tech.
- Carullo, Jeff, 2006, *Effects of Freestream Turbulence, Turbulence Length Scale, and Reynolds Number on Turbine Blade Heat Transfer in a Transonic Cascade*, Mechanical Engineering, Virginia Tech.
- Lawson, Seth, 2007, *Heat Transfer from Multiple Row Arrays of Low Aspect Ratio Pin Fins*, Mechanical Engineering, Virginia Tech.
- Thrift, Alan, 2007, *Aerodynamic Force and Pressure Loss Measurements on Low Aspect Ratio Pin Fin Arrays*, Mechanical Engineering Department, Virginia Tech.

- Lynch, Steve, 2007, *Endwall Heat Transfer and Shear Stress for a Nozzle Guide Vane with Fillets and a Leakage Interface*, Mechanical Engineering, Virginia Tech (1st Place Poster for the Paul E. Torgersen Graduate Student Research Excellence Award).
- Ostaneck, Jason, 2008, *Establishing a Methodology for Resolving Convective Heat Transfer from Complex Geometries*, Mechanical Engineering, Penn State.
- Musgrove, Grant, 2009, *Computational Predictions and Experimental Measurements of the Performance of a Louver Particle Separator for Use in Gas Turbine Engines*, Mechanical Engineering, Penn State.
- Neely, Gaelyn, 2009, *Heat Transfer and Friction Factor Augmentation in Rib Turbulated Flow*, Mechanical Engineering, Penn State.
- Weaver, Steve, 2010, *Heat Transfer and Pressure Drop Augmentation in Micro Channels with Pin Fins*, Mechanical Engineering, Penn State.
- Breneman, Duane, 2011, *Dirt Plugging in a Seal Pin Geometry*, Mechanical Engineering, Penn State.
- Eberly, Molly, 2012, *Shaped Film Cooling Studies at High Density Ratios*, Mechanical Engineering, Penn State.
- Kirsch, Katie, 2013, *Pin Fin Surface Heat Transfer in Arrays of Oblong-Shaped Pin Fins*, Mechanical Engineering, Penn State.
- Whitfield, Chris, 2013, *High Density Ratio Film Cooling*, Mechanical Engineering, Penn State.
- Shrager, Adam, 2017, *Flowfield Measurements Relative to Dilution Jets in a Combustor*, Mechanical Engineering, Penn State.
- Huelsmann, Nathan, 2020, *Effects of Jet Impingement on Convective Heat Transfer and Discharge Coefficients in Effusion Holes*, Mechanical Engineering, Penn State.

Masters of Science Advisees

- Cory, Trevor, Novel Materials for Turbine Airfoils
 Creer, Riley, Combustor Liner Heat Transfer
 Edelson, Ryan, Heat Transfer of Novel Materials for Turbine Airfoils

Diplom Advisees

- J. Sauer, *Development of a High Freestream Turbulence Generator*, Diplom Arbeit, 1996.
 M. Schwaenen, *Simulations of Pin Fin Arrays*, Diplom Arbeit, 2005.

Undergraduate Senior Honor Theses and Research Supervised

- Nikki Matson, 1996, University of Wisconsin
 Brian Kang, 1997, University of Wisconsin
 Will Colban 2001, Virginia Tech (NSF Graduate Fellowship Honorable Mention)
 Jesse Christophel, 2002, Virginia Tech
 William Ranson, 2003, Virginia Tech
 Andrew Graham, 2003, Virginia Tech (NSF Graduate Fellowship Recipient)
 Scott Walsh, 2003, Virginia Tech (University Turbine Systems Fellowship Recipient)
 Joe Scrittore 2003, Virginia Tech (University Turbine Systems Fellowship Recipient)
 Kaitlin Keim, 2004, 2004-05, Virginia Tech
 Elizabeth Hoppe, 2005, Virginia Tech

Betsy Thompson, 2005, Virginia Tech
Jason Ostanek, 2005, Virginia Tech (SMART Fellowship Recipient)
Benjamin Cruz-Perez (Univ of Puerto Rico-Mayaguez), 2007, Penn State
Josuan Hilerio-Sánchez (Univ of Puerto Rico-Mayaguez), 2007, Penn State
John Lucena Jimenez (Univ of Puerto Rico-Mayaguez), 2008, Penn State
Scott Fishbone, 2010, Penn State, *Measurements of Thermal Conductivity*
Elizabeth Donofrio, 2010, Penn State, *Measurements of Pin Fin Heat Transfer*
Jacob Snyder, 2013, Penn State, *Development of a CO2 Sensing Device*
Shane Haydt, 2013, Penn State, *Pin Fin Spacing Visualization*
Carly Seneca, 2013, Penn State, *Pin Fin Shape Effects*
Mimi Overbaugh, 2013, Penn State, *Attachment Methods for Thermocouples*
Jeffrey Glusman, 2013, Penn State, *Simulating Roughness Effects for Film Cooling*
Kate Fersten, 2016-17, Penn State, *Additive Manufactured Pin Fin Studies*
Jackie Trautman, 2017, Penn State, *Additive Manufactured Component Testing*
Carolyn Orth, 2017, Penn State, *Comparison of Various Additive Manufacturing Processes*
Sara Fox, 2020, Penn State, *Dirt Deposition on AM Parts*
Haylee Wormer, 2020, Penn State, *Properties of AM Parts*

Non-Tenure Faculty, Staff, and Post Doctorate Supervision

Scott Fishbone, Project Manager, Steady Thermal Aero Research Turbine (START) Lab,
July 2018-present
Mike Barringer, Research Associate Professor, Steady Thermal Aero Research Turbine
(START) Lab, January 2007-present
Reid Berdanier, Research Assistant Professor, Steady Thermal Aero Research Turbine
(START) Lab, July 2016-present
Jeremiah Bunch, Research Engineering Technician, Steady Thermal Aero Research Turbine
(START) Lab, July 2016 - present
Jay Neal, Project Manager, Steady Thermal Aero Research Turbine (START) Lab, July
2016-2018
David Johnson, Research Associate, Steady Thermal Aero Research Turbine (START) Lab,
October 2012-Dec 2017
Andrew Coward, Research Associate, Steady Thermal Aero Research Turbine (START)
Lab, October 2012-2015
Ting Wang, Visiting Professor from Shanghai Jiao Tong University, *Studies in Particle-Gas
Flows*, August 2010-May 2011
Nick Cardwell, Post-Doctorate from Virginia Tech, *Time-Resolved Digital Particle Image
Velocimetry Studies in Ribbed Channels*, January 2010-May 2010
Narayan Sundaram, Post-Doctorate from Virginia Tech, *Investigation of Gaps on Turbine
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- 52 Kunze, V., Wolff, M., Barringer, M., Thole, K. A., Polanka, M., "Numerical Insight into Flow and Thermal Patterns within an Inlet Profile Generator Comparing to Experimental Results," International Gas Turbine and Aeroengine Congress and Exposition, Barcelona, GT2006-90276.
- 51 Cardwell, N., Narayan, S., and Thole, K. A. "The Effects of Varying the Combustor-Turbine Gap," International Gas Turbine and Aeroengine Congress and Exposition, Barcelona, GT2006-90089.*
- 50 Colban, W., Thole, K. A., and Haendler, M., "A Comparison of Cylindrical and Fan-Shaped Film-Cooling Holes on a Vane Endwall at Low and High Freestream Turbulence Levels," International Gas Turbine and Aeroengine Congress and Exposition, Barcelona, GT2006-90021.*
- 49 Narayan, S. and Thole, K. A. "Effects of Surface Deposition, Hole Blockage, and TBC Spallation on Vane Endwall Film-Cooling," GT2006-90379.*
- 48 Colban, W., Thole, K. A., and Haendler, M., "Experimental and Computational Comparisons of Fan-Shaped Film-Cooling on a Turbine Vane Surface," International Mechanical Engineering Congress, Orlando, IMECE2005-79596, recipient of the W. M. Rohsenow Prize for Best Presentation for the Gas Turbine Heat Transfer Committee.*
- 47 V. R. Kunze and M. Wolff M. D. Barringer and K. A. Thole M. D. Polanka, "Numerical Modeling of Flow and Thermal Patterns Within a Combustor Simulator," International Gas Turbine and Aeroengine Congress and Exposition, Reno, GT2005-68284.
- 46 Scrittore, J., Thole, K. A., and Burd, S., "Experimental Characterization of Film-Cooling Effectiveness Near Combustor Dilution Holes," International Gas Turbine and Aeroengine Congress and Exposition, Reno, GT2005-68704.*

- 45 Colban, W., Thole, K. A., and Haendler, M., "Heat Transfer and Film-Cooling Measurements on a Stator Vane with Fan-Shaped Cooling Holes," International Gas Turbine and Aeroengine Congress and Exposition, Reno, GT2005-68258.*
- 44 Cardwell, N., Sundaram, N., and Thole, K. A., "Effects of Roughness and Mid-Passage Gap on Endwall Film Cooling," International Gas Turbine and Aeroengine Congress and Exposition, Reno, GT2005-68704.*
- 43 Ranson, W., Thole, K. A., and Cunha, F. "Adiabatic Effectiveness Measurements and Predictions of Leakage Flows Along a Blade Endwall," International Mechanical Engineering Congress, Anaheim, IMECE2004-62021.*
- 42 Kunze, V. R., Wolff, M., Barringer, M., Thole, K., and Polanka, M., "Developing a Combustor Simulator for Investigating High Pressure Turbine Aerodynamics and Heat Transfer," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53613.
- 41 Christophel, J. R., Thole, K., and Cunha, F., "Cooling the Tip of a Turbine Blade Using Pressure Side Holes-Part 2: Heat Transfer Measurements," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53254.*
- 40 Christophel, J. R., Thole, K., and Cunha, F., "Cooling the Tip of a Turbine Blade Using Pressure Side Holes-Part 1: Film Effectiveness Measurements," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53251.*
- 39 Christophel, J. R., Couch, E., Thole, K., and Cunha, F., "Measured Adiabatic Effectiveness and Heat Transfer for Blowing from the Tip of a Turbine Blade," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53250.*
- 38 Knost, D. G., and Thole, K. A., "Adiabatic Effectiveness Measurements of Endwall Film-Cooling for a First Stage Vane," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-52236.
- 37 Graham, A., and Thole, K. A., "Flowfield Measurements in a Ribbed Channel Relevant to Internal Turbine Blade Cooling," International Gas Turbine and Aeroengine Congress and Exposition, International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53361.
- 36 Smith, A. C., Hatchett, J. H., Nix, A. C., Ng, W. F., and Thole, K. A., "Effectiveness of Normal and Angled Slot Cooling," International Gas Turbine and Aeroengine Congress and Exposition, Vienna, GT2004-53248.
- 35 Vakil, S. and Thole, K. A., 2003, "Flow and Thermal Field Measurements in a Combustor Simulator Relevant to a Gas Turbine Aero-Engine," International Gas Turbine and Aeroengine Congress and Exposition, Atlanta, GT-2003-38254.*
- 34 Lethander, A., Thole, K. A., Zess, G., and Wagner, J., "Optimizing the Vane-Endwall Junction to Reduce Adiabatic Wall Temperatures in a Turbine Vane Passage," International Gas Turbine and Aeroengine Congress and Exposition, Atlanta, GT-2003-38940.*
- 33 Stitzel, S. and Thole, K. A., 2003, "Flow Field Computations of Combustor-Turbine Interactions Relevant to a Gas Turbine Engine," International Gas Turbine and Aeroengine Congress and Exposition, Atlanta, GT-2003-38253.*
- 32 Knost, D. and Thole, K. A., 2003, "Computational Predictions of Endwall Film-Cooling for a First Stage Vane," International Gas Turbine and Aeroengine Congress and Exposition, Atlanta, GT-2003-38252.

- 31 Hohlfield, E., Couch, E., Christophel, J. and Thole, K. A., 2003, "Predictions of Cooling from Dirt Purge Holes Along the Tip of a Turbine Blade," International Gas Turbine and Aeroengine Congress and Exposition, Atlanta, GT-2003-38251. *
- 30 Pang, Y. F., Chen, J. Z., Scott, E. P., and Thole, K. A., 2002, "Electrical and Thermal Layout Design and Optimization Considerations for DPS Active IPEM," New Orleans, IMECE2002-33778.
- 29 Nix, A., Smith, A. C., Diller, T. E., Ng, W. F., and Thole, K. A., 2002, "High Intensity, Large Length Scale, Freestream Turbulence Generation in a Transonic Turbine Cascade," International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, ASME Paper GT-2002-30523.
- 28 Hermanson, K. and Thole, K. A., 2002, "Effect on Non-Uniform Inlet Conditions on Endwall Secondary Flows," International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, GT-2002-30188.*
- 27 Colban, W. F., Lethander, A., T., Thole, K. A., and Zess, G., 2002, "Combustor-Turbine Interface Studies: Part 2: Flow and Thermal Field Measurements," International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, GT-2002-30527.*
- 26 Colban, W. F., Thole, K. A., and Zess, G., 2002, "Combustor-Turbine Interface Studies: Part 1: Endwall Measurements," International Gas Turbine and Aeroengine Congress and Exposition, Amsterdam, GT-2002-30526.*
- 25 Harrington, M., McWaters, M., Bogard, D., Lemmon, C., and Thole, K. A. "Full-Coverage Film Cooling with Short Normal Injection Holes," International Gas Turbine and Aeroengine Congress and Exposition, New Orleans, 2001-GT-0130.*
- 24 Radomsky, R. and Thole, K. A., 2001, "Detailed Boundary Layer Measurements on a Turbine Stator Vane at Elevated Freestream Turbulence Levels," International Gas Turbine and Aeroengine Congress and Exposition, New Orleans, 2001-GT-0169.*
- 23 Barringer, M. D., Richard, O. T., Walter, J. P., Stitzel, S. M., and Thole, K. A., 2001, "Flow Field Simulations of a Gas Turbine Combustor," International Gas Turbine and Aeroengine Congress and Exposition, New Orleans, 2001-GT-0170.
- 22 Zess, G. A. and Thole, K. A., 2001, "Computational Design and Experimental Evaluation of Using a Leading Edge Fillet on a Gas Turbine Vane," International Gas Turbine and Aeroengine Congress and Exposition, New Orleans, 2001-GT-0404.*
- 21 Thole, K. A., Radomsky, R., Kang, M., and Kohli, A., 2001, "Elevated Freestream Turbulence Effects on Heat Transfer for a Gas Turbine Vane," Turbulent Heat Transfer Conference, Anchorage, AK, March.
- 20 Radomsky, R., and Thole, K. A., 2000, "High Freestream Turbulence Effects in the Endwall Leading Edge Region," International Gas Turbine and Aeroengine Congress and Exposition, Munich Germany, 2000-GT-201.*
- 19 Lemmon, C., Kohli, A., and Thole, K. A., 1999, "Formation of Counter-Rotating Vortices in Film-Cooling Flows," International Gas Turbine and Aeroengine Congress and Exposition, Indianapolis Indiana, 99-GT-161.
- 18 Radomsky, R. and Thole, K. A., 1999, "Highly Turbulent Flowfield Measurements Around a Stator Vane," International Gas Turbine and Aeroengine Congress and Exposition, Indianapolis Indiana, 99-GT-253.*

- 17 Kang, M., and Thole, K. A., 1999, "Flowfield Measurements in the Endwall Region of a Stator Vane," International Gas Turbine and Aeroengine Congress and Exposition, Indianapolis Indiana, 99-GT-188.*
- 16 Zhang, L. W., Memory, S. B., Wattelet, J. P., Springer, M.E., and Thole, K. A., 1999, "A Combined Experimental and Computational Study of Flowfields in a Louvered Fin Heat Exchanger," VTMS 4, ICE, London United Kingdom.
- 15 Hermanson, K. and Thole, K.A., 1999, "Effect of Inlet Conditions on Endwall Secondary Flows," AIAA Aerospace Meeting, Reno Nevada, AIAA Paper 99-0241.
- 14 Springer, M., and Thole, K. A., Zhang, L. W., Memory, S. B., and Wattelet, J. P., Modine Manufacturing, 1998, "A Combined CFD and LDV Study of Flowfields in Louvered Fin Heat Exchangers," ASME Fluids Engineering Division Meeting, Paper Number FEDSM98-4843.
- 13 Kohli, A., and Thole, K. A., 1998, "Entrance Effects on a Diffused Film-Cooling Hole," International Gas Turbine and Aeroengine Congress and Exposition, Stockholm Sweden, 98-GT-402.
- 12 Kang, M., Kohli, A., and Thole, K. A., 1998, "Heat Transfer and Flowfield Measurements in the Leading Edge Region of a Stator Vane Endwall," International Gas Turbine and Aeroengine Congress and Exposition, Stockholm Sweden, 98-GT-173.*
- 11 Radomsky, R., and Thole, K. A., 1998, "Effects of High Freestream Turbulence Levels and Length Scales on Stator Vane Heat Transfer," International Gas Turbine and Aeroengine Congress and Exposition, Stockholm Sweden, 98-GT-236.
- 10 Kohli, A., and Thole, K. A., 1997, "A CFD Investigation on the Effect of Entrance Flow Conditions in Discrete Film Cooling Holes," 32nd National Heat Transfer Conference, vol. 12, pp. 223-232, W. M. Rohsenow Prize for Best Presentation for the Gas Turbine Heat Transfer Committee.
- 9 Martin, C., and Thole, K. A., 1997, "A CFD Benchmark Study: Leading Edge Film Cooling with Compound Angle Injection," presented to The International Gas Turbine and Aeroengine Congress and Exposition, Orlando, Florida, 97-GT-297.
- 8 Bangert, B., Kohli, A., Sauer, J., and Thole, K. A., 1997, "High Freestream Turbulence Simulation in a Scaled-Up Turbine Vane Passage," International Gas Turbine and Aeroengine Congress and Exposition, Orlando, Florida, 97-GT-51.
- 7 Thole, K. A., Gritsch, M., Schulz, A., and Wittig, S., 1996, "Flowfield Measurements for Cooling Holes with Expanded Exits," International Gas Turbine and Aeroengine Congress and Exposition, Birmingham England, 96-GT-174.*
- 6 Wittig, S., Schulz, A., Gritsch, M., and Thole, K. A., 1996, "Transonic Film Cooling Investigations: Effects of Hole Shapes and Orientations," International Gas Turbine and Aeroengine Congress and Exposition, Birmingham England, 96-GT-222.*
- 5 Laudon, M. F., Engelstad, R. L., Thole, K. A., Dauksher, W. J., Resnick, D. J., Cummings, K. D., and Seese, P. and Johnson, W., 1995, "Modeling of In-Plane Distortions due to Variations in Absorber Stress," International Micro- and Nano- Engineering, Aix-en-Provence France.
- 4 Laudon, M. F., Thole, K. A., Engelstad, R. L., Resnick, D. J., Cummings, K. D., and Dauksher, W. J., 1995, "Thermal Analysis of X-ray Membrane in a Plasma Environment," 39th International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication, Phoenix Arizona.

- 3 Thole, K. A., and Bogard, D. G., 1994, "Enhanced Heat Transfer and Skin Friction due to High Freestream Turbulence," International Gas Turbine and Aeroengine Congress and Exposition, The Hague Netherlands 94-GT-296.*
- 2 Thole, K. A., Whan-Tong, J., and Bogard, D. G., 1991, "Generation of Very High Freestream Turbulence Levels and the Effects on Heat Transfer," 27.5.1-27.5.7, Turbulent Shear Flow Conference, Munich, Germany.
- 1 Thole, K. A., Sinha, A., Bogard, D. G., and Crawford, M. E., 1990, "Mean Temperature Measurements of Jets with a Crossflow for Gas Turbine Film Cooling Application," Rotating Machinery Transport Phenomena, J. H. Kim and W. J. Yang, ed. Hemisphere Publishing Corporation, New York, New York.

Publications Recommended for Conference Publication

Knisely, B. F., Berdanier, R. A., Thole, K. A., Haldeman, C. W., Markham, J. R., Cosgrove, J. E., Carlson, A. E., Scire, J. J., "Acquisition and Processing Considerations for Infrared Images of Rotating Turbine Blades," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-15522.

Wildgoose, A. J., Thole, K. A., Sanders, P. Wang, L., "Impact of Additive Manufacturing on Internal Cooling Channels with Varying Diameters and Build Directions," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-15049.

Huelsmann, N. C., Thole, K. A., "Effects of Jet Impingement on Convective Heat Transfer in Effusion Holes," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-15577.

Wilkins, P. H., Lynch, S. P., Thole, K. A., Quach, S., Vincent, T., "Experimental Heat Transfer and Boundary Layer Measurements on a Ceramic Matrix Composite Surface," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-15053.

Winkelman, B., Kurz, R., Voss, D., and Thole, K. A., "Collaboration Between Academia and Industry to Advance Industrial Gas Turbines," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-14168.

McClain, S. T., Hanson, D. R., Cinnamon, E., Snyder, J. C., Kunz, R. F., Thole, K. A., "Flow in a Simulated Turbine Blade Cooling Channel with Spatially Varying Roughness Caused by Additive Manufacturing Orientation," International Gas Turbine and Aeroengine Congress and Exposition, London, GT2020-14809.

NON-PEER REVIEWED PUBLICATIONS

Lieuwen, T. C. and Thole, K. A., "As industry makes large investments in gas turbine technology, advanced manufacturing will play an important role in improving performance and reducing costs" *At the Intersection*, ME Magazine, ASME, June 2016.

PROFESSIONAL SOCIETY MEMBERSHIPS

- American Society of Mechanical Engineers (ASME), Fellow
- American Institute of Aeronautics and Astronautics (AIAA), Associate Fellow
- ASME Student Section, Penn State Faculty Advisor (2007-2012)
- ASME Gas Turbine Heat Transfer Committee (K-14), Member
- American Society of Engineering Education (ASEE), Member
- Society of Women Engineers, Member
- State of Wisconsin Professional Engineering License (License Number 30951)
- Pi Tau Sigma, Member and Virginia Tech Student Section Advisor (2000-2003)

EDITORIAL AND REVIEW ACTIVITIES

- Editorial Advisory Board, *Physics of Fluids* 2018-present
- Associate Editor, *AIAA Journal of Thermophysics*, January 2017-present
- Associate Editor, *ASME Journal of Turbomachinery*, July 2006-2013
- Associate Editor, *International Journal of Heat and Fluid Flow*, July 2006-09
- Associate Editor, *ASME Journal of Heat Transfer*, January 2003-July 2006
- Reviewer for the *Journal of Fluid Mechanics*, *Journal of Turbomachinery*, *Journal of Heat Transfer*, *International Journal of Heat and Mass Transfer*, *Journal of Fluids Engineering*, *Experiments in Fluids*, *Experimental Thermal Fluid Science*
- Panel reviewer for the National Science Foundation's Chemical and Thermal Transport Division including several CAREER and unsolicited proposal panels
- Panel reviewer for the National Science Foundation Graduate Fellowship Program
- Reviewer for the National Science Foundation's ADVANCE Program
- Reviewer for the National Science Foundation's Graduate Research Fellowship Program

EDUCATIONAL AND INSTITUTIONAL CHANGE GRANTS

The Pennsylvania State University

EAGER: Identifying and Disseminating Transformative Professional Development of STEM Undergraduates Who Perform Outreach

National Science Foundation

Total amount: \$299,999

PI: Thole; Co-PIs: M. Alley, and J. Garner (Old Dominion University)

2017-2020 (3 years)

Improvements to ME 340, Junior Level Design

Leonhard Center for Engineering Education

Total amount: \$50,000

PI: T. Simpson; Co-PI: K. Thole

2016-2017 (Two years)

Creating a National Network of Engineering Ambassadors: A Professional Development Program with an Outreach Mission

National Science Foundation

Total amount: \$600,000 with \$500,000 to Penn State

PI: Thole; Co-PIs: M. Alley, and J. Garner (Old Dominion University)

2013-2017 (4 years)

Forming a Successful Engineering Ambassador Program Workshop

National Science Foundation and Penn State's Electro Optics Center

Total amount: \$75,000

PI: Thole; Co-PI: R. Engel, Associate Dean, College of Engineering

2012-13 (1.5 years)

Communicating What Mechanical Engineers Do: A Strategy for Recruiting Women

National Science Foundation

Total amount: \$100,000

PI: Thole; Co-PI: Frecker, Alley, Zappe

2009-2011 (One year)

Mechanical and Nuclear Engineering Global, Non-Travel Based Capstone Design Projects

Leonhard Center for Engineering Education

Total amount: \$68,500

PI: M. Trethewey; Co-PI: Thole

2010-2011 (Two years)

Virginia Polytechnic Institute and State University

NSF Advance Institutional Transformation Award

National Science Foundation

Total amount: \$3.5M

PI: McNamee; Co-PIs: Hyer, Love, Thole

2003-2008 (Five years)

RESEARCH GRANTS – EXTERNAL (LAST FIVE YEARS)
(Total: over \$36M including grants, contracts, and gifts)

The Pennsylvania State University

Turbine Cooling through Additive Manufacturing

FAA ASCENT Program / United Technologies Corporation-Pratt & Whitney

Total amount: \$1,200,000

PI: K. A. Thole

2020-22 (Three Years)

Improving Turbine Efficiencies through Heat Transfer and Aerodynamic

Research in the Steady Thermal Aero Research Turbine (START) – National Experimental Turbine (NExT)

Department of Energy-National Energy Technology Lab

Total amount: \$11,067,120

PI: K. A. Thole

2015-20 (Five Years)

Integration of Sensors through Additive Manufacturing Leading to Increased Efficiencies of Gas turbines for Power Generation and Propulsion

Advanced Research Projects Agency-Energy-Open Solicitation

Total amount: \$5,879,897

PI: K. A. Thole

2019-22 (Three Years)

Integrated turbine component cooling designs facilitated by additive manufacturing and optimization

Department of Energy-National Energy Technology Lab: University Turbine Research Program

Total amount: \$400,000

PI: K. A. Thole

2019-22 (Three Years)

Gas Turbine Fuel Reduction through Minimally Cooled Vanes and Blades

FAA CLEEN 2 Program / United Technologies Corporation-Pratt & Whitney

Total amount: \$2,631,460

PI: K. A. Thole

2015-19 (Four Years)

Characterization of Single Hole and Multi-Row Heat Transfer Relevant to Combustor Liners

Pratt & Whitney

Total Amount: \$271,500

PI: K. A. Thole

2019-20 (two years)

Internal Flow Testing for Future Turbine Components

Pratt & Whitney

Total Amount: \$509,247

PI: K. A. Thole and S. P. Lynch

2019-20 (two years)

Thermal Performance of Advanced Cooling Channel Concepts

Pratt & Whitney

Total Amount: \$331,822

PI: K. A. Thole

2019-20 (two years)

Film Cooling Testing for Future Turbine Components

Pratt & Whitney

Total Amount: \$166,642

PI: K. A. Thole

2019 (one year)

Characterizing Coke Deposition in Additively Manufactured Parts

Air Force Research Laboratory (with Reaction Systems)

Total Amount: \$56,000

PI: K. A. Thole

2019 (one year)

Conjugate Heat Transfer for LES of Gas Turbine Engines

U.S. Navy STTR Program (with Cascade Technologies)

Total Amount: \$72,000

PI: K. A. Thole

2019 (one year)

Characterization of Additively Manufactured Channels

Siemens Energy

Total Amount: \$210,000

PI: K. A. Thole

2018 (two years)

Testing and Characterization of an Additively Manufactured Tip Shoe and Combustor Liner

Solar Turbines

Total Amount: \$255,021

PI: K. A. Thole; co-PI: T. Simpson

2019 (1.5 years)

START Turbine Upgrade

Pratt & Whitney

Total Amount: \$64,645

PI: K. A. Thole

2019 (one year)

Smooth Wall TOBI and Baseline

Pratt & Whitney

Total Amount: \$215,000

PI: K. A. Thole

2018 (one year)

Dirt Ingestion Studies for Turbine Components

Pratt & Whitney

Total Amount: \$130,000

PI: K. A. Thole

2018 (one year)

Scalable Predictive Analytics for Real-Time Life Predictions of Critical Gas Turbine Components

Department of Energy – University Turbine Systems Research Program

Total Amount: \$700,000

PI: K. A. Thole (\$267,525)

2018 (three years)

Investigating Under-Platform Geometry Impacts on Secondary Flow and Main Gas Interactions

Pratt & Whitney

Total Amount: \$149,499

PI: K. A. Thole

2017 (one year)

NAVY SBIR: Micro-Plasma Blade Monitoring Sensor Testing

Innoveering, LLC

Total Amount: \$15,000

PI: K. A. Thole

2017 (one year)

LES and RANS/DERM Modeling for Design Optimization of Additively and Conventionally Manufactured Internal Turbine Cooling Passages

US Department of Energy, National Energy Technology Laboratory - University Turbine Systems Research (UTSR)

Total Amount: \$600,000

PI: R. Kunz; co-PI: Thole

2018 (Three years)

Real-Time Health Monitoring of Gas Turbine Components Using Online Learning and High-Dimensional Data

U.S. Department of Energy – National Energy Technology Laboratory: University Turbine Systems Research (UTSR)

10/1/2017-9/30/2020

Total Amount: \$212,775

2017 (Three Years)

Addressing Turbine Durability Concerns Associated with Imposed Transient Propulsion Needs

Office of Naval Research – Defense University Research Instrumentation Program (DURIP)

Total amount: \$490,104

PI: K. A. Thole

2017 (One year)

Dirt Ingestion Studies for Turbine Components

United Technologies Corporation-Pratt & Whitney

Total amount: \$130,000

PI: K. A. Thole

2017 (One Year)

Evaluating Overall Effectiveness of Combustor Panels

United Technologies Corporation-Pratt & Whitney

Total amount: \$169,000

PI: K. A. Thole

2017 (One Year)

Evaluating Overall Effectiveness of Combustor Panels

Power Systems Manufacturing – Ansaldo Group

Total amount: \$216,000

PI: K. A. Thole

2017-18 (1.5 yrs)

Instrumentation into the START Test Turbine

United Technologies Corporation-Pratt & Whitney

Total amount: \$45,000

PI: K. A. Thole

2016 (One Year)

Heater Integration into START Facility

United Technologies Corporation-Pratt & Whitney

Total amount: \$193,000

PI: K. A. Thole

2016 (One Year)

RT Rig Instrumentation Improvements and Flow Capacity Expansion

United Technologies Corporation-Pratt & Whitney

Total amount: \$500,000

PI: K. A. Thole
2016 (One Year)

Effects of Leakage on Aerodynamic Performance
United Technologies Corporation-Pratt & Whitney
Total amount: \$215,000

PI: K. A. Thole
2015 (One Year)

Small Cavity Seal Testing
United Technologies Corporation-Pratt & Whitney
Total amount: \$378,539

PI: K. A. Thole
2015 (One Year)

Installation of Fast Acting Valves into START Facility
United Technologies Corporation-Pratt & Whitney
Total amount: \$165,000

PI: K. A. Thole
2014 (One Year)

Providing a Testbed for Turbine Sensor Development with Engine Relevant Rotational Effects
Office of Naval Research
Total amount: \$527,000

PI: K. A. Thole
2014 (One year)

Airfoil Heat Transfer for a Regenerative Cooled Gas Turbine
DOE/ARPA-E with Aerojet
Total amount: \$275,000

PI: K. A. Thole
2013-14 (Two years)

Nanocellular Materials for Transpiration Cooling
United Technologies Research Center / Office of Naval Research
Total amount: \$140,000

PI: K. A. Thole
2013-2015 (Two years)

Understanding and Mitigating Tip Leakage and Endwall Losses in High Pressure Ratio Cores
NASA
Total amount: \$735,501

PI: K. A. Thole (\$300,083)
Co-PI: C. Camci
2011-2014 (Three years)

High Thermal Efficiency Cooling Concepts
Pratt & Whitney
Total amount: \$646,500

PI: K. A. Thole
2011-15 (Five years)

Improving Durability of Turbine Components through Trenched Film Cooling and Contoured Endwalls

Department of Energy-University Turbine Systems Research Program

Total amount: \$334,000 (including cost-share)

PI: K. A. Thole (\$167,000)

Co-PI: M. Barringer

2010-2014 (Three years)

Development of a Rotating Rig to Study Secondary Flow Leakages and Aerothermal Cooling

Department of Energy-National Energy Technology Lab

Total amount: \$998,085

PI: K. A. Thole (\$499,042); Co-PI: M. Barringer

2011-14 (Four years)

Increased Heat Transfer through Advanced Micro Cooling

Pratt & Whitney

Total amount: \$497,626

PI: K. A. Thole (\$377,626); Co-PI: M. Barringer

2010-13 (Four years)

Advanced Film-Cooling Designs with Simulations of High Density Ratio Injection

Pratt & Whitney

Total amount: \$670,626

PI: K. A. Thole (\$608,876)

2010-2014 (Five years)

Characterization of Rust for Turbine Component Studies

Siemens Energy

Total amount: \$167,572

PI: K. A. Thole (\$83,786); Co-PI: M. Barringer

2009-2011 (Two years)

GIFT FUNDS FOR RESEARCH SUPPORT-EXTERNAL

The Pennsylvania State University

START Support

Pratt & Whitney

Total amount: \$200,000

PI: K. A. Thole (\$100,000)

2019

START II Support

Pratt & Whitney

Total amount: \$200,000

PI: K. A. Thole (\$100,000)

2018

START II Lab Construction

Pratt & Whitney

Total amount: \$200,000

PI: K. A. Thole (\$100,000)
2016

START I Turbine Rig Facility

Pratt & Whitney

Total amount: \$2.74M

PI: K. A. Thole (\$2.74M)

2010-15

Match funds for Department of Energy University Turbine Systems Research contract

Pratt & Whitney

Total amount: \$120,000

PI: K. A. Thole (\$120,000)

2010-2013

Laboratory Renovation

Pratt & Whitney

Total amount: \$50,000

PI: K. A. Thole (\$50,000)

2009

Support for Doctoral Student

Pratt & Whitney

Total amount: \$50,000

PI: K. A. Thole (\$50,000)

2009

Laboratory Renovation

Pratt & Whitney

Total amount: \$30,000

PI: K. A. Thole (\$30,000)

2009

Funds for Laboratory Equipment

Pratt & Whitney

Total amount: \$100,000

PI: K. A. Thole (\$100,000)

2008

Center of Excellence Support

Pratt & Whitney

Total amount: \$25,000

PI: K. A. Thole (\$25,000)

2008

Funds for Laboratory Equipment

Pratt & Whitney

Total amount: \$300,000

PI: K. A. Thole (\$300,000)

2008

LABORATORY DEVELOPMENT

DESCRIPTION OF EXPERIMENTAL AND COMPUTATIONAL CONVECTION LAB

The Experimental and Computational Convection Laboratory (ExCCL) conducts studies of fundamental turbulence and applied convective heat transfer. Subjects being researched include freestream turbulence effects on gas turbine blade boundary layers, endwall secondary flow effects, turbine blade cooling techniques, and electronic cooling. These problems are approached both experimentally as well as computationally. Within the laboratory, experimental facilities include two wind tunnels and internal flow channels. Instrumentation includes time-resolved digital particle image velocimeter, laser Doppler velocimeter, hot-wire anemometer, and infrared thermography. Computational facilities include a cluster and many desktop computers. The research conducted within the laboratory is supported through federal agencies as well as industry. In 2007, the laboratory was given the distinction of being a Pratt & Whitney Center of Excellence for gas turbine heat transfer. In 2015, Dr. Thole stepped down as the Director to develop the START Lab whereby the new Director was changed to Associate Professor Stephen Lynch.

DESCRIPTION OF STEADY THERMAL AERO RESEARCH TURBINE (START) LAB

The Steady Thermal Aero Research Turbine Lab houses a unique, state-of-the-art 1.5 turbine in which blade Reynolds numbers and rotational Reynolds numbers are matched to that of an engine. The primary goals for this turbine facility include: developing improved sealing mechanisms for inter-stage gaps; developing novel cooling methods for turbine airfoils; validating sensors in rotating environments; and integrating the use of advanced manufacturing for turbine airfoil cooling and for sensor integration. In addition to the turbine, the START lab houses a dynamic seal test rig and benchtop facility that evaluates the heat transfer and pressure loss in true-scale heat transfer coupons made through the use of additive manufacturing. The development of Penn State's START Lab occurred through an initial and continuing partnership between Penn State, the Department of Energy-National Energy Technology Lab, and Pratt & Whitney. The START Lab is included in the Pratt & Whitney Center of Excellence and in 2018, Solar Turbines awarded their sole Center of Excellence to Penn State, which includes the START Lab.