

PHIL LIGRANI

Eminent Scholar in Propulsion, Professor of Mechanical and Aerospace Engineering, Department of Mechanical and Aerospace Engineering, Propulsion Research Center, 5000 Technology Drive, University of Alabama at Huntsville, Huntsville, AL 35899 USA.

PROFESSIONAL PREPARATION

University of Texas at Austin	Mechanical Engineering	Bachelor of Science, 1974
Stanford University	Mechanical Engineering	Master of Science, 1975
Stanford University	Mechanical Engineering	Doctor of Philosophy, 1980

APPOINTMENTS

2014 – present	Eminent Scholar in Propulsion, Professor of Mechanical and Aerospace Engineering, Propulsion Research Center, Department of Mechanical and Aerospace Engineering, University of Alabama at Huntsville
2010 – 2014	Oliver L. Parks Endowed Chair, Professor of Aerospace and Mechanical Engineering, Parks College, Saint Louis University
2010 – 2013	Director of Graduate Programs, Parks College, Saint Louis University
2006 – 2009	Statutory Professor, Department of Engineering Science, University of Oxford, Donald Schultz Professor of Turbomachinery
2006 – 2009	Director, Rolls-Royce UTC (University Technology Centre) in Heat Transfer and Aerodynamics, University of Oxford
1997 – 2006	Professor, Department of Mechanical Engineering, University of Utah
2002 – 2006	Adjunct Professor, Department of Bioengineering, University of Utah
1992 – 1997	Associate Professor, Department of Mechanical Engineering, University of Utah

ARCHIVAL JOURNAL PUBLICATIONS AND RELATED ITEMS.

As of May 2023, Dr. Ligrani is author or co-author of more than 220 publications in archival journals, including the International Journal of Heat and Mass Transfer, the ASME Transactions-Journal of Turbomachinery, the ASME Transactions-Journal of Engineering for Gas Turbines and Power, the ASME Transactions-Journal of Heat Transfer, the ASME Transactions-Journal of Fluids Engineering, the International Journal of Thermal Sciences, Nature - Scientific Reports, the Journal of Fluid Mechanics, the AIAA Journal, Experiments in Fluids, Physics of Fluids, the AIAA Journal of Heat Transfer and Thermophysics, the International Journal of Rotating Machinery, Separation Science and Technology, Sensors and Actuators A: Physical, Measurement Science and Technology, Applied Thermal Engineering, and the Journal of Microcolumn Separations. He is also author of 10 book chapters, and about 165 conference presentations and publications. A number of these are invited conference presentations at international meetings, at locations which include Korea, France, the Ukraine, Croatia, Germany, England-United Kingdom, and Belgium. From 1994 to 2023, he has also presented approximately 202 lectures at different institutions and establishments, including many invited lectures. From 2006 to 2023, he presented or is scheduled to present approximately 7 Invited Keynote Papers, 12 Invited Papers, and 12 Invited Plenary Keynote Papers at different international conferences. Current SCOPUS Reference Citation H-INDEX is 48. Current GOOGLE SCHOLAR Reference Citation H-INDEX is 54.

RESEARCH FUNDING AWARDS

Dr. Ligrani has a strong past and present record of performing sponsored, fundamental and applied research for a variety of funding agencies, including ones in the USA and Europe. As such, he has successfully managed a wide variety of research programs, for different industrial, foundation, and government sponsors. **As of May 2023, research funding awards have been received from the following organizations:** U.S. Air Force Research Laboratory - Aerospace Systems Directorate, CFDRC – Computational Fluid Dynamics Research Corporation, Alabama State Innovation Program Fund, University of Alabama in Huntsville Endowment for Eminent Scholar in Propulsion, University of Alabama in Huntsville Start-Up Funds, AEDC – Arnold Engineering Development Center of Arnold Air Force Base, National Science Foundation, Honeywell Aerospace Corp., The Boeing Company, IHI Corporation, the Henry Luce Foundation, South Carolina Institute for Energy Studies (SCIES-AGTSR) of the Department of Energy, U. S. Army Aviation Research and Technology Activity-AVSCOM, NASA-Ames Research Center, NASA-Lewis Research Center, Hispanic Research Center-Arizona State University, Turbo and Power Machinery Research Center-Seoul National University, Solar Turbines Incorporated, UCON U.S.-Japan Center-Weber State University, General Electric Corporate Research and Development Center, Pratt & Whitney Corporation-Florida, the North Atlantic Treaty Organization (NATO), Pratt & Whitney Corporation-Canada Corp., the Gas Technology Institute, Intel Corporation, HEET-High Efficiency Engines and Turbines Program - South Carolina Energy Research and Development Center, Invesys Corp. - Foxboro Company, Ceramatec Advanced Materials and Electrochemical Technologies Corp., CISCO Systems Inc., SEEDA-South East England Development Agency, EPSRC – Engineering and Physical Sciences Research Council of Great Britain, ISIS Innovation, John Fell Fund, European Community Sixth Framework Programme, Korea Institute of Geoscience and Mineral Resources - KIGAM, Lockheed Martin UK, The Royal Academy of Engineering, Rolls Royce PLC, Science and Engineering Research Council (SERC) Engineering Board of Great Britain, Office of Naval Research, Naval Postgraduate School Research Foundation, Aero-Propulsion Laboratory-Wright-Patterson Air Force Base, and Naval Postgraduate School Direct Funding.

UNIVERSITY OF ALABAMA IN HUNTSVILLE - CURRENT AND RECENT RESEARCH FUNDING AWARDS

As of May 2023, current and recent research sponsors at the University of Alabama in Huntsville include: (1) Solar Turbines, Inc. of San Diego, California, USA (multiple research contracts), (2) IHI Corp. (Ishikawajima Harima Heavy Industries), of Tokyo, Japan (multiple research contracts), (3) National Science Foundation, CBET Thermal Transport Processes, Division of Chemical, Bioengineering, Environmental, and Transport (CBET) Systems, Arlington, Virginia, USA (multiple funding awards), (4) the Alabama Innovation Fund, Research Program, Montgomery, Alabama, USA, (5) Office of the Vice President for Research and Economic Development, University of Alabama in Huntsville, Huntsville, Alabama, USA, (6) AEDC – Arnold Engineering Development Center, Arnold Air Force Base, Tullahoma, Tennessee, USA (high pressure tank donation), (7) U.S. Air Force Research Laboratory, SBIR/STTR Program, Aerospace Systems Directorate, Wright-Patterson Air Force Base, Ohio, USA.

GRADUATE STUDENT SUPERVISION

As of May 2023, successfully supervised a total of 105 graduate student theses and dissertations associated with Ph.D., M.S., M.E., and Diploma degrees. Of these, successfully supervised a total of 10 theses and dissertations of women graduate students, and a total of 14 Ph.D. dissertations.

SELECTED RECENT HONORS, AWARDS, ACADEMIC RECOGNITIONS

- 2020 College of Engineering Outstanding Faculty Member Award. University Award, University of Alabama in Huntsville, Huntsville, Alabama, USA.
- 2020 Undergraduate Research and Creative Activity Mentor Award. University of Alabama in Huntsville, Huntsville, Alabama, USA.
- May 2020. Hermann Oberth Award in recognition of outstanding individual scientific achievement in the field of astronautics and advancement of the aeronautical sciences. AIAA – American Institute of Aeronautics and Astronautics. Greater Huntsville Section of the AIAA, Huntsville, Alabama, USA.
- March 2020. Employee Service Award, Five Years of Service. University of Alabama in Huntsville, Huntsville, Alabama, USA.
- ASME IGTI Outstanding Service Award 2019.
- 2019 University Distinguished Research Award for Excellence. University of Alabama in Huntsville, Huntsville, Alabama, USA.
- Outstanding Senior Faculty Member Award for 2019. College of Engineering, University of Alabama in Huntsville, Huntsville, Alabama, USA.
- Member. European Union Academy of Sciences (EUAS). 2019 to present.
- Guest Professor. School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai, P. R. China. 2019 to 2022.
- Outstanding Mechanical Engineer of the Year Award 2016, ASME – American Society of Mechanical Engineers, NAS - North Alabama Section, USA.
- Marquis Lifetime Achievement Award, Marquis Who's Who, New Providence, New Jersey, USA, 2016.
- Distinguished Advisory Professor, Inje University, South Korea, 2010 to 2022.
- Distinguished Lecture Award, 2011, CEAS Distinguished Lecture Series, College of Engineering, University of Wisconsin, Milwaukee, Wisconsin, USA.
- Distinguished Editorial Review Board membership for Springer Publishing Corporation.
- Carl E. and Jessie W. Menneken Faculty Award for Excellence in Scientific Research.
- NASA Space Act Tech Brief Award for "Development of Subminiature Multi-Sensor Hot-Wire Probes."
- Silver Winner for the Annual 26th Educational Advertising Awards for the Higher Education Marketing Report.

RESEARCH AREAS AND EXPERTISE.

Dr. Ligrani has a strong past and present record of working with many different collaborators and co-workers, from many locations throughout the world. Additional information on selected, currently active research projects is provided within sections which follow.

(i) **Traditional Heat Transfer and Fluid Mechanics Investigations** involving electronics cooling, heat transfer augmentation, drag reduction, turbulent boundary layers, flows in channels with dimpled surfaces, flows in curved channels, elastic turbulence, slot impingement cooling, and macro-scale pumps and pump flows. Also included are **aerodynamics investigations with high-speed, compressible flows at transonic and supersonic Mach numbers**, including SWBLI – Shock Wave Boundary Layer Interactions. Related projects involve **transonic and supersonic experimental testing**. Research interests also include experimental diagnostics in high speed flows, and air breathing propulsion.

(ii) **Air Breathing Engines - Gas Turbine Heat Transfer, Cooling, and Aerodynamics Losses**, including internal cooling, film cooling, impingement cooling, cooling of extremities, aerodynamic performance including aerodynamic losses, and transonic turbine flows and heat transfer. This subject area includes the effects of uses of bio-fuels, synthetic fuels, and renewable energy sources in relation to gas turbines and gas turbine heat transfer and cooling technologies. Note that an important area of turbomachinery research interest involves heat transfer and aerodynamics investigations with *high-speed, compressible flows at transonic and supersonic Mach numbers*, including linear cascade studies.

(iii) **Micro-Fluidics and Millimeter-Scale-Fluidics**, including micro-pump flows, and the effects of slip phenomena on gas and liquid flows in micro-scale passage flows with and without surface roughness, including the effects of hydrophobic surfaces and elastic turbulence.

(iv) **Experimental Techniques**, including development of millimeter-scale multiple-hole pressure probes, subminiature hot-wire anemometry, and infrared thermography.

EDITORSHIPS

1. Guest Editor, Special Topical Issue on "Measuring Techniques for Turbomachinery," Measurement Science and Technology, 1998-2000.

2. Associate Technical Editor, ASME Transactions-Journal of Heat Transfer, July 1, 2003 – June 30, 2007.
3. “Special Issues on Gas Turbine Heat Transfer: Parts 1 and 2,” ASME Transactions-Journal of Heat Transfer, Co-Editor with S. Acharya, Part 1 - April 2005, Part 2 – May 2005.
4. Associate Technical Editor, ASME Transactions-Journal of Fluids Engineering, July 1, 2005 – December 31, 2008.
5. Member, Distinguished Editorial Review Board, Advances in Transport Phenomena, Book Series, Springer Publishing Corporation, 2006 – Present.
6. Associate Technical Editor, ASME Transactions-Journal of Heat Transfer, July 1, 2010 – June 30, 2014.
7. Editorial Board Member, International Journal of Innovative Works in Engineering and Technology (IJWET). ISSN: 2455-5797, Published by NAANJIL, India. October 2015 – Present.
8. Associate Editor, ASME Transactions-Journal of Journal of Engineering for Gas Turbines and Power, July 1, 2018 - June 30, 2021.
9. Associate Editor, ASME Transactions-Journal of Journal of Engineering for Gas Turbines and Power, July 1, 2021 - June 30, 2024.
10. Academic Editor, International Journal of Rotating Machinery, Hindawi Publishing Co., London, England, United Kingdom, April 2022 – Present.
11. Editorial Board Member, International Journal of Aeronautical Science and Aerospace Research (IJASAR), SciDoc Publishing Co., Lewes, Delaware, USA, January 2023 – Present.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS AND ACTIVITIES

- ASME, Member, American Society of Mechanical Engineering, July 1985-Present.
- ASME, Fellow, American Society of Mechanical Engineering, December 2000-Present.
- ASME, American Society of Mechanical Engineering, K-14 Gas Turbine Heat Transfer Committee. December 1986-Present.
Executive Committee and Membership Committee, July 2018-June 2020. Chairman (Entire Committee), July 2016-June 2018. Vice Chairman (Entire Committee), July 2014-June 2016. Chairman, Honors and Awards Sub-Committee, July 2012-June 2014.
- IGTI, International Gas Turbine Institute Heat Transfer Committee. December 1986-Present
- ASEE, Member, American Society for Engineering Education, September 2010-Present.
- AIAA, Member, American Institute of Aeronautics and Astronautics, January 2013 – Present.
- AIAA, Associate Fellow, American Institute of Aeronautics and Astronautics, January 2016 – Present.
- AIAA, American Institute of Aeronautics and Astronautics, Member, High Speed Air Breathing Propulsion (HSABP) Technical Committee, September 2022 – Present. Member, Gas Turbine Engine (GTE) Technical Committee, February 2023 – Present.
- ICHMT – International Center for Heat and Mass Transfer. Member of the Scientific Council, January 2014 – Present.

INTERNATIONAL SCIENTIFIC COMMITTEE MEMBERSHIPS.

1. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 7-8, 2023.
2. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.
3. Conference Organizing Committee, 2021 3rd International Conference on Mechanical, Aerospace and Automotive Engineering (CMAAE 2021), Sponsored by the Hong Kong Society of Robotics and Automation and the Central South University (P. R. China), Changsha, P. R. China, December 3-5, 2021.
4. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence- SEC (Buckinghamshire, England, United Kingdom), Arlington, Virginia, USA, November 2-3, 2021.
5. Conference Co-Chairman, 4th International Conference and Expo on Aerospace and Aeronautical Engineering (ICEAAE-2021, Aerospace-2021), Valencia, Spain, Virtual Event, October 25-27, 2021.
6. Member of the Scientific Committee, HMTSF-2019, Seventh International Conference “Heat and Mass Transfer and Hydrodynamics in Swirling Flows,” National Committee on Heat and Mass Transfer of the Russian Academy of Sciences, Rybinsk, Russian Federation, October 16-18, 2019.
7. Invited Member. European Union Academy of Sciences (EUAS). An international scientific organization and among the most prestigious in Europe. The academy is composed of distinguished members worldwide, including the world’s leading scientists, scholars and business people, aiming to promote excellence in science and technology. Membership was the result of an election done through President’s Council consisting of the distinguished members of the Board of Governors. January 2019 to Present.
8. Invited Expert of the Aerospace Center of Multiscale Mechanics and Thermodynamics (The Overseas Expertise Introduction Center for Discipline Innovation), School of Aeronautic Science and Engineering (ASE), Beihang University, Beijing, P. R. China. A 111 Project, which is sponsored by the State Administration of Foreign Experts Affairs, Beijing, P. R. China. September 2018 to September 2022.

9. Academic Committee Member, 2018 ICAYS Organizing Committee, ICAYS – 2018 International Conference in Aerospace for Young Scientists, September 15-16, 2018. School of Aeronautic Science and Engineering (ASE), Beihang University, Beijing, P. R. China. July to October 2018.
10. Member of the Scientific Committee, ICHHFF6, Sixth International Conference “Heat and Mass Transfer and Hydrodynamics in Swirled Flows,” Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russian Federation, November 21-23, 2017.
11. Member of the Scientific Committee, ICHHFF5, Fifth International Conference “Heat and Mass Transfer and Hydrodynamics in Swirled Flows,” National Committee of the Russian Academy of Sciences, Kazan, Russian Federation, October 19-21, 2015.
12. Vice-Chairman and Member, Academic Committee, Institute of Gas Turbines, Beijing Tsinghua University, Beijing, P. R. China. February 2014-February 2017.
13. ICHMT, Scientific Council Member, International Center for Heat and Mass Transfer. Nominated for membership by Professor Richard Goldstein of the University of Minnesota. January 2014 to Present.
14. International Scientific Committee, International Symposium on “Heat Transfer in Gas Turbine Systems,” Antalya, Turkey, August 9-14, 2009.
15. International Conference on Mechanical Engineering-Algeria, Ministere de l’Enseignement Superieur et de la Recherche Scientifique, Oran, Algeria, April 28-29, 2002.

RECENT U.S. NATIONAL SERVICE ACTIVITIES

1. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 7-8, 2023.
2. Panel Moderator for Panel Session, “Testing and Simulation Developments for Hypersonics,” Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.
3. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.
4. Panel Member for Panel Session, “Applied Radiation Tracking for Defensive Hypersonic Weapons,” 2022 Hypersonic Weapons Summit, 4th Annual Hypersonic Weapons Summit, Institute for Defense and Government Advancement (IDGA) of the International Quality and Productivity Center (IQPC) (London, England, United Kingdom), Arlington, Virginia, USA, September 28-29, 2022.
5. Panel Member, Thermal Transport Processes (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2022.
6. Panel Member, Reviewer, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2022.
7. Report Reviewer, Consultant, “Complex Air Defense – Countering the Hypersonic Missile Threat,” CSIS Missile Defense Project, Center for Strategic and International Studies (CSIS), Washington, D.C., USA, December 2021.
8. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence- SEC (Buckinghamshire, England, United Kingdom), Arlington, Virginia, USA, November 2-3, 2021.
9. Panel Member, Thermal Transport Processes (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2021.
10. Hypersonic Aerodynamics. Online On-Demand Course. Taught by Professor Jason Cassibry, with topics of skin friction, heat transfer, and turbulence presented by Special Guest Lecturer Phil Ligrani. Spring, Summer, Fall Semesters of 2021, 2022, 2023.
11. Participation as Panelist, “Gas Turbine Cooling and Aerodynamics” Panel, American Society of Thermal and Fluids Engineers (ASTFE) Conference, Fort Lauderdale, Florida, USA, March 4-7, 2018.
12. Panel Member, Thermal Transport Processes (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2017.
13. Panel Member, Thermal Transport Processes (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2016.
14. Sponsored Representative, CVD – Congressional Visits Day, U. S. Senate and House of Representatives, Washington, D. C. Sponsored by Greater Huntsville Section of the AIAA – American Institute of Aeronautics and Astronautics, March 4, 2015.
15. Panel Member, Convection (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2014.
16. Participation as Panelist, “Educating Today’s and Tomorrow’s Propulsion Engineers” Panel, “Continuing Education and Professional Development” Program of the AIAA Science and Technology Forum and Exposition - SCITECH 2014, Washington, D.C., January, 13-17, 2014.

17. Participant, Second Graduate Deans Workshop on Institutionalizing Interdisciplinary Graduate Education, Virginia Tech, Virginia Polytechnic Institute and State University, and National Science Foundation, Arlington, Virginia, USA, November 1-2, 2012.
18. Participant, Graduate Deans Workshop on Institutionalizing Interdisciplinary Graduate Education, Virginia Tech, Virginia Polytechnic Institute and State University, and National Science Foundation, Arlington, Virginia, USA, April 2-3, 2012.
19. Panel Member, Convection (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2011.
20. Panel Member, Thermal Transport Processes Program (Unsolicited) Panel, Thermal Transport Processes Program, Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division, National Science Foundation, Arlington, Virginia, USA, 2010.
21. Panel Member, Thermal Transport and Thermo Processing (TTTP) Program, Chemical and Transport Systems (CTS) Division, National Science Foundation, Arlington, Virginia, USA, 2005.
22. Session Chair, External Turbine Cooling, Aero-Heat Transfer Workshop, SCIES-South Carolina Institute for Energy Studies, Baton Rouge, Louisiana, USA, November 11-13, 2002.

UNIVERSITY OF ALABAMA IN HUNTSVILLE – COLLEGE and UNIVERSITY SERVICE ACTIVITIES

1. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, February 2023.
2. Member and Chairman, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, October 2022.
3. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, February 2022.
4. Member, Committee to Evaluate College of Engineering 2021 Undergraduate Research Program Faculty Proposals, University of Alabama in Huntsville, October 2021.
5. Member, UAH COE Strategic Plan 2032: Goal 2. Leadership in Research, Scholarship, and Creative Achievement, Committee Member, College of Engineering, University of Alabama in Huntsville, September 2021-April 2022.
6. Member, Awards Judging Committee, Research Horizon Day Poster Presentations, University of Alabama in Huntsville, March 2021.
7. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, February 2021.
8. Member, University Awards Committee for Undergraduate Research and Creative Activity Mentor Award, University of Alabama in Huntsville, January–February 2021.
9. Member, Search Committee, Associate Provost for Graduate Studies, International Services, and Academic Integrity, University of Alabama in Huntsville, November 2020 – September 2021.
10. Alternate Member, CoE PTAC, College of Engineering - Promotion and Tenure Advisory Committee, College of Engineering, University of Alabama in Huntsville, September 2020 – August 2021.
11. Member, University Awards for Excellence Committee, University of Alabama in Huntsville, September 2020 – August 2021.
12. Member, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, September 2020.
13. Member, Graduate Handbook Revision Committee, UAH Graduate Council, University of Alabama in Huntsville, April-May 2020.
14. Member, University Awards for Excellence Committee, University of Alabama in Huntsville, February – August 2020.
15. Member, Ad Hoc Committee for Leadership in Research, UAH Strategic Plan 2028, University of Alabama in Huntsville, January – April 2020.
16. Member, Graduate Mentor Award Committee, UAH Graduate Council, University of Alabama in Huntsville, February 2020.
17. Member, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, January 2020.
18. Member, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, January 2020.
19. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, January 2020.
20. CoE PTAC, College of Engineering - Promotion and Tenure Advisory Committee, College of Engineering, University of Alabama in Huntsville, September 2019 – August 2020.
21. Member, Committee to consider Junior Faculty Member – Tenure with Promotion to the Rank of Associate Professor, College of Engineering, University of Alabama in Huntsville, December 2019.
22. Member, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, April 2019.
23. Member, Graduate Mentor Award Committee, UAH Graduate Council, University of Alabama in Huntsville, February 2019.

24. Member, College of Engineering 2019 Research Horizons Poster Session Review Committee, College of Engineering, University of Alabama in Huntsville, February 2019.
25. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, January 2019.
26. Member, College of Engineering University Research Proposals Review Committee, College of Engineering, University of Alabama in Huntsville, December 2018.
27. Member, CoE PTAC, College of Engineering - Promotion and Tenure Advisory Committee, College of Engineering, University of Alabama in Huntsville, September 2017 – August 2018.
28. Member and Chairman, Committee to consider Senior Faculty Member Appointment with Tenure to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, June 2018.
29. Member, College of Engineering Mid-Career Proposals Review Committee, College of Engineering, University of Alabama in Huntsville, April 2018.
30. Member, Graduate Advisor Award Committee, UAH Graduate Council, University of Alabama in Huntsville, February 2018.
31. Member, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, February 2018.
32. Member and Chairman, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, January 2018.
33. Member and Chairman, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, November 2017.
34. Faculty Mentor to Junior Faculty Member, Assistant Professor, Department of Mechanical and Aerospace Engineering, College of Engineering, University of Alabama in Huntsville, October 2017 – Present.
35. President's Council Member, University of Alabama in Huntsville, August 2017 – Present.
36. Member, College of Engineering Mid-Career Proposals Review Committee, College of Engineering, University of Alabama in Huntsville, April 2017.
37. Member, College of Engineering Best Teaching Award Review Committee, College of Engineering, University of Alabama in Huntsville, April 2017.
38. Member, Committee to consider Junior Faculty Member – Reappointment at the Rank of Assistant Professor, College of Engineering, University of Alabama in Huntsville, January 2017.
39. Member, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor with Tenure, College of Engineering, University of Alabama in Huntsville, June – July 2016.
40. Member, College of Engineering Mid-Career Proposals Review Committee, College of Engineering, University of Alabama in Huntsville, March 2016.
41. COE (College of Engineering) Representative and Member, UAH Graduate Council, University of Alabama in Huntsville, August 2015 – September 2021.
42. Member, MAE Graduate Programs Committee, Department of Mechanical and Aerospace Engineering, College of Engineering, University of Alabama in Huntsville, August 2015 – December 2022.
43. Member, Task Force on Discussion of Immigration Matters Related to Hiring of Foreign Faculty, University of Alabama in Huntsville, July 2015 - Present.
44. Member, MAE PTAC, Mechanical and Aerospace Engineering Department - Promotion and Tenure Advisory Committee, Department of Mechanical and Aerospace Engineering, College of Engineering, University of Alabama in Huntsville, August 2014 – Present.
45. Representative Member and Alternate, CoE PTAC, College of Engineering - Promotion and Tenure Advisory Committee, College of Engineering, University of Alabama in Huntsville, September 2014 – August 2016.
46. Member, Search Committee, Eminent Scholar in Systems Engineering, College of Engineering, University of Alabama in Huntsville, September 2014 – May 2015.
47. Member and Chairman, Committee to consider Senior Faculty Member – Promotion to the Rank of Full Professor, College of Engineering, University of Alabama in Huntsville, November 2014 – January 2015.

ARCHIVAL JOURNAL PUBLICATIONS – LAST 5 YEARS

2018

175. Heat Transfer Enhancements From Elastic Turbulence Using Sucrose-Based Polymer Solutions (P. M. Ligrani, D. Copeland, C. Ren, M. Su, and M. Suzuki), *AIAA Journal of Thermophysics and Heat Transfer*, Vol. 32, No. 1, pp. 51-60, January 2018.
176. Internal and External Cooling of a Full Coverage Effusion Cooling Plate: Effects of Double Wall Cooling Configuration and Conditions (Z. Ren, S. R. Vanga, N. Rogers, P. M. Ligrani, K. D. Hollingsworth, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), *International Journal of Thermal Sciences*, Vol. 124, pp. 36-49, February 2018.
177. Vortex Structure Effects on Impingement, Effusion, and Cross Flow Cooling of a Double Wall Configuration (P. M. Ligrani), *Journal of Physics: Conference Series*, IOP Science Publishing Corp., Vol. 980, pp. 012018-1 to 012018-15, March 2018

178. Flow Structure and Surface Heat Transfer From a Turbine Component Endwall Contoured Using the Ice-Formation Method (S. Winkler, B. Weigand, and P. M. Ligrani), *International Journal of Heat and Mass Transfer*, Vol. 120, pp. 895-908, May 2018.

179. Double Wall Cooling of a Full-Coverage Effusion Plate, Including Internal Impingement Array Cooling (P. M. Ligrani, Z. Ren, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), *ASME Transactions-Journal of Engineering for Gas Turbines and Power*, Vol. 140, No. 5, pp. 051901-1 to 051901-9, May 2018.

180. Effects of Hole Shape On Impingement Jet Array Heat Transfer With Small-Scale, Target Surface Triangle Roughness (P. McInturff, M. Suzuki, P. M. Ligrani, C. Nakamata, and D. H. Lee), *International Journal of Heat and Mass Transfer*, Vol. 127, Part A, pp. 585-597, December 2018.

2019

181. Winglet-Pair Target Surface Roughness Influences On Impingement Jet Array Heat Transfer (P. M. Ligrani, P. McInturff, M. Suzuki, and C. Nakamata), *Journal of Enhanced Heat Transfer*, Vol. 26, No. 1, pp. 15-35, January 2019.

182. Analysis of Shock Wave Unsteadiness Using Space and Time Correlations Applied to Shadowgraph Flow Visualization Data (S. R. Marko, and P. M. Ligrani), *Advances in Aerodynamics*, Vol. 1, No. 2, pp. 1-25, February 2019.

183. Double Wall Cooling of a Full Coverage Effusion Plate With Cross Flow Supply Cooling and Main Flow Pressure Gradient (P. M. Ligrani, Z. Ren, S. R. Vanga, C. Allgaier, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), *ASME Transactions-Journal of Engineering for Gas Turbines and Power*, Vol. 141, No. 3, pp. 031015-1 to 031015-11, March 2019.

184. Double Wall Cooling of a Full Coverage Effusion Plate With Main Flow Pressure Gradient, Including Internal Impingement Array Cooling (S. R. Vanga, D. Ritchie, A. J. Click, Z. Ren, P. M. Ligrani, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), *ASME Transactions-Journal of Turbomachinery*, Vol. 141, No. 4, pp. 041002-1 to 041002-11, April 2019.

185. Double Wall Cooling of an Effusion Plate With Simultaneous Cross Flow and Impingement Jet Array Internal Cooling (D. Ritchie, A. J. Click, P. M. Ligrani, F. Liberatore, R. Patel, and Y.-H. Ho), *ASME Transactions-Journal of Engineering for Gas Turbines and Power*, Vol. 141, No. 9, pp. 091008-1 to 091008-11, September 2019.

186. Flow and Heat Transfer Characteristics of Micro Pin-Fins Under Jet Impingement Arrays (X. Lu, W. Li, X. Li, J. Ren, H. Jiang, and P. M. Ligrani), *International Journal of Heat and Mass Transfer*, Volume 143, Paper No. 118416, pp. 1-14, November 2019.

2020

187. Parametric Study of Wind Tunnel Test Section Configurations For Stabilizing Normal Shock Wave Structure (P. M. Ligrani, and S. R. Marko), *Shock Waves*, Vol. 30, No. 1, pp. 77-90, January 2020.

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212. Transonic Turbine Blade Tip Heat Transfer With Pressure Side Film Cooling (H. Collopy, P. M. Ligrani, H. Xu, and M. Fox), *AIAA Journal of Thermophysics and Heat Transfer*, Vol. 36, No. 3, pp. 720–733, July 2022.
213. Dusting Hole Film Cooling Heat Transfer on a Transonic Turbine Blade Tip (W. Mannes Schmidt, H. Collopy, P. M. Ligrani, K. Goethals, M. Cox, H. Xu, and M. Fox), *International Journal of Rotating Machinery*, Volume 2022, Article ID 2006572, pp. 1- 15, October 2022.
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BOOK CHAPTERS

1. Structure of Turbulent Boundary Layers (P. M. Ligrani), *Aerodynamics and Compressible Flows*, *Encyclopedia of Fluid Mechanics* (Editor: N. Chermisnoff), Vol. 8, pp. 111-189, Gulf Publishing, October 1988.
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3. Transient, Oscillatory and Steady Characteristics of Dean Vortex Pairs in a Curved Rectangular Channel (P. M. Ligrani), *Ordered and Turbulent Patterns in Taylor-Couette Flow* (Editors: C. David Andereck and F. Hayot), *NATO Advanced Science Institutes Series Volume, Series B: Physics Vol. 297*, Plenum Press Publishing Corporation, pp. 281-288, October 1992.
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5. Effects of Curvature on Heat Transfer in Channels and Swirl Chambers (P. M. Ligrani), *Recent Research Developments in Heat, Mass, & Momentum Transfer*, Vol. 2-1999, (Editor: S. G. Pandalai), Research Signpost Publishers, Vol. 2, pp. 171-183, 1999.
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9. Full-Coverage Effusion Cooling in External Forced Convection: Sparse and Dense Hole Arrays (P. M. Ligrani), *Handbook of Thermal Science and Engineering* (Editor-in-Chief: Francis A. Kulacki), Springer International Publishing AG, Springer Publishing Corporation, New York, New York, USA. Chapter 10, pp. 425-446, 2018.
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CONFERENCE PUBLICATIONS AND PRESENTATIONS – LAST 5 YEARS

2018

130. Gas Turbine Component Heat Transfer and Cooling Research Directions (P. M. Ligrani), Panelist, “Gas Turbine Cooling and Aerodynamics” Panel, American Society of Thermal and Fluids Engineers (ASTFE) Conference, Fort Lauderdale, Florida, USA, March 4-7, 2018.
131. Double Wall Cooling of a Full Coverage Effusion Plate With Main Flow Pressure Gradient, Including Internal Impingement Array Cooling (S. R. Vanga, Z. Ren, A. J. Click, P. M. Ligrani, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), Paper Number GT2018-77036, *ASME TURBO EXPO 2018: Turbomachinery Technical Conference and Exposition*, Lillestrom, Oslo, Norway, June 11-15, 2018.

132. Double Wall Cooling of a Full Coverage Effusion Plate With Cross Flow Supply Cooling and Main Flow Pressure Gradient (C. Allgaier, Z. Ren, S. R. Vanga, P. M. Ligrani, F. Liberatore, R. Patel, R. Srinivasan, and Y.-H. Ho), Paper Number GT2018-77061, ASME TURBO EXPO 2018: Turbomachinery Technical Conference and Exposition, Lillestrom, Oslo, Norway, June 11-15, 2018.
133. Propulsion Research and Academic Programs at the University of Alabama in Huntsville – PRC Laboratory Capabilities - 2018 (R. Frederick, P. M. Ligrani, and L. D. Thomas), Paper Number AIAA 2018-4805, 2018 AIAA Propulsion and Energy Forum and Exposition, AIAA – American Institute of Aeronautics and Astronautics, Cincinnati, Ohio, USA, July 10-12, 2018.
134. Aerospace and Aeronautical Engineering at the University of Alabama in Huntsville (P. M. Ligrani), Plenary Lecture, 2018 ASE International Week, Forum of the Future of Aerospace Engineering, School of Aeronautic Science and Engineering (ASE), Beihang University, Beijing, P. R. China, September 12-14, 2018.
135. Heat Transfer Enhancements From Elastic Turbulence Within Rotating Couette Flow Using Sucrose-Based Polymer Solutions (P. M. Ligrani), Plenary Lecture, ICAYS – 2018 International Conference in Aerospace for Young Scientists, School of Aeronautic Science and Engineering (ASE), Beihang University, Beijing, P. R. China, September 15-16, 2018.
136. Investigations of Normal Shock Wave Unsteadiness (P. M. Ligrani), Invited Paper, First International Symposium on Advances in Aerodynamics, Chengdu, Sichuan Province, P. R. China, December 14-15, 2018.

2019

137. Linear Cascade and Wind Tunnel Development for Turbine Blade Tip Heat Transfer Investigations With and Without Film Cooling (M. Sampson, A. Fairbanks, J. Moseley, P. M. Ligrani, H. Xu, and M. Fox), Paper Number GT2019-91074, ASME TURBO EXPO 2019: Turbomachinery Technical Conference and Exposition, Phoenix, Arizona, USA, June 17-21, 2019.
138. Propulsion Research and Academic Programs at the University of Alabama in Huntsville – PRC Strategic Plan 2019 (L. D. Thomas, R. A. Frederick, and P. M. Ligrani), Paper Number AIAA 2019-3891, 2019 AIAA Propulsion and Energy Forum, AIAA – American Institute of Aeronautics and Astronautics, Indianapolis, Indiana, USA, August 19-22, 2019.
139. Double Wall Cooling of an Effusion Plate With Cross Flow and Impingement Jet Combination Internal Cooling: Comparisons of Main Flow Contraction Ratio Effects (D. Ritchie, A. J. Click, P. M. Ligrani, F. Liberatore, R. Patel, and Y.-H. Ho), Paper Number AIAA-2019-3967, 2019 AIAA Propulsion and Energy Forum, AIAA – American Institute of Aeronautics and Astronautics, Indianapolis, Indiana, USA, August 19-22, 2019.
140. Effects of Coolant Supply Arrangement on Double Wall Cooling: Hot-Side Effusion Performance and Cold-Side Nusselt Numbers at Different Initial Blowing Ratios (A. J. Click, D. Ritchie, P. M. Ligrani, F. Liberatore, R. Patel, and Y.-H. Ho), Paper Number AIAA 2019-3965, 2019 AIAA Propulsion and Energy Forum, AIAA – American Institute of Aeronautics and Astronautics, Indianapolis, Indiana, USA, August 19-22, 2019.
141. Recent Research Developments for Turbine Blade Tip Heat Transfer, Including Development and Effects of Tip Leakage Vortices (H. Collopy, M. Sampson, and P. M. Ligrani), Invited Plenary Keynote Paper, HMTHSF-2019, Seventh International Conference “Heat and Mass Transfer and Hydrodynamics in Swirling Flows,” National Committee on Heat and Mass Transfer of the Russian Academy of Sciences, Rybinsk, Russian Federation, October 16-18, 2019.
142. Academic and University Roles and Partnerships in the Development of Hypersonic Weapons (P. M. Ligrani), Invited Keynote Paper, 1st Annual Hypersonic Weapons Summit, 2019 Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, October 28-30, 2019.

2020

143. Physical Phenomena Associated With Hypersonic Weapon Vehicles (P. M. Ligrani), Invited Briefing Paper, 2nd Annual Hypersonic Weapons Summit, Digital Summit, 2020 Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, March 31-April 2, 2020.
144. Physical Phenomena Associated With Hypersonic Weapon Vehicles (P. M. Ligrani), Invited Briefing Paper, Hypersonic Weapon Systems, Digital Summit, IQPC, Defense IQ, London, England, United Kingdom, June 30-July 1, 2020.
145. Hypersonic Weapon Vehicles: Physical Effects and Phenomena (P. M. Ligrani), Invited Briefing Paper, Countermeasures Hypersonic Weapons Summit, Digital Summit, 2020 Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, July 23-24, 2020.
146. Propulsion Research and Academic Programs at the University of Alabama in Huntsville – PRC Graduate Student Production History (R. A. Frederick, L. D. Thomas, and P. M. Ligrani), Paper Number AIAA 2020-3909, AIAA Propulsion and Energy 2020 Forum, AIAA – American Institute of Aeronautics and Astronautics, Virtual Event, USA, August 24-26, 2020.
147. Louver Slot Cooling and Full-Coverage Film Cooling With a Combination Internal Coolant Supply (A. J. Click, P. M. Ligrani, M. Hockensmith, J. Knox, C. Larson, A. Fairbanks, F. Liberatore, R. Patel, and Y.-H. Ho), Paper Number GT2020-14520, ASME TURBO EXPO 2020: Turbomachinery Technical Conference and Exposition, Virtual Event, Virtual Online Conference, September 21-25, 2020.

148. Fostering Hypersonic Innovation Through Decisive Academic Research and Collaboration (P. M. Ligrani), Invited Briefing Paper, Hypersonic Weapons Summit, Digital Summit, 2020 2nd Annual Hypersonic Weapons Conference, IDGA - Institute for Defense and Government Advancement, Washington, D.C., USA, October 28-30, 2020.

149. R&D in Experimental Heat Transfer Diagnostics for Supersonic and Hypersonic Flow Environments (P. M. Ligrani), Invited Briefing Paper, Autonomous and Hypersonic Weapons Systems Conference, Technology Training Corporation (TTC), Washington, D.C., USA, November 4-6, 2020.

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150. Propulsion Research and Academic Programs at the University of Alabama in Huntsville – 30th Anniversary Summary (R. A. Frederick, P. M. Ligrani, and L. D. Thomas), Paper Number AIAA 2021-3347, AIAA Propulsion and Energy 2021 Forum, AIAA – American Institute of Aeronautics and Astronautics, USA, Virtual Event, August 9-11, 2021.

151. Topic AF19B-T012, Tailored Supersonic Flow Fields: Flow Shaping Technology to Enhance Test Rigs for Supersonic Inlets (M. Ostrander, S. Roth, and P. M. Ligrani), Propulsion-Airframe Integration Technical Interchange Meeting (PAI-TIM), Air Force / NASA / Industry / University Participation, Virtual Meeting, June 15-17, 2021.

152. Recent Investigations of Transonic, Supersonic, and Hypersonic Flow Phenomena (P. M. Ligrani), Invited Keynote Paper, 4th International Conference and Expo on Aerospace and Aeronautical Engineering (ICEAAE-2021, Aerospace-2021), Valencia, Spain, Virtual Event, October 25-27, 2021.

153. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Arlington, Virginia, USA, November 2-3, 2021.

154. Surface Heat Transfer Characteristics of Transonic Turbine Blade Tip Configurations With and Without Film Cooling (P. M. Ligrani), Invited Keynote Paper, 2021 3rd International Conference on Mechanical, Aerospace and Automotive Engineering (CMAAE 2021), Sponsored by the Hong Kong Society of Robotics and Automation and the Central South University (P. R. China), Changsha, P. R. China, Online Event, December 3-5, 2021.

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155. Effects of Pressure Side Film Cooling Hole Placement and Condition on Surface Heat Transfer Characteristics of a Transonic Turbine Blade Tip (P. M. Ligrani), Invited Plenary Paper, Global Experts Conference on Applied Science, Engineering and Technology (GECAET-2022), Virtual Conference and Amsterdam, Netherlands, July 28-29, 2022.

156. Panel Member for Panel Session, “Applied Radiation Tracking for Defensive Hypersonic Weapons,” 2022 Hypersonic Weapons Summit, 4th Annual Hypersonic Weapons Summit, Institute for Defense and Government Advancement (IDGA) of the International Quality and Productivity Center (IQPC) (London, England, United Kingdom), Arlington, Virginia, USA, September 28-29, 2022.

157. Radiation Tracking Literature Overview (P. M. Ligrani), Invited Esteemed Speaker, 2022 Hypersonic Weapons Summit, 4th Annual Hypersonic Weapons Summit, Institute for Defense and Government Advancement (IDGA) of the International Quality and Productivity Center (IQPC) (London, England, United Kingdom), Arlington, Virginia, USA, September 28-29, 2022.

158. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.

159. Panel Moderator for Panel Session, “Testing and Simulation Developments for Hypersonics,” Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.

160. Utilization of Electromagnetic Radiation for Detection, Tracking, and Characterization of Hypersonic Vehicles (P. M. Ligrani), Invited Paper, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 8-9, 2022.

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161. Effects of Dusting Film Cooling Placement and Configuration on Surface Heat Transfer Characteristics of a Transonic Turbine Squealer Blade Tip (H. Collopy, P. M. Ligrani, H. Xu, and M. Fox), Paper Number AIAA-2023-0883, 2023 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum), American Institute of Aeronautics and Astronautics, Gaylord National Harbor Hotel, National Harbor, Maryland, USA, January 23-27, 2023.

162. Utilization of Electromagnetic Radiation for Detection, Tracking, and Characterization of Hypersonic Vehicles (P. M. Ligrani), Invited Paper, 2023 Hypersonic Weapons Summit, 5th Annual Hypersonic Weapons Summit, Institute for Defense and Government Advancement (IDGA) of the International Quality and Productivity Center (IQPC) (London, England, United Kingdom), Arlington, Virginia, USA, August 20-21, 2023.

163. Conference Chairman, Hypersonic Defense Conference and Exhibition, Intelligence-SEC (Buckinghamshire, England, United Kingdom), Huntsville, Alabama, USA, November 7-8, 2023.

164. Recent Investigations of Transonic, Supersonic, and Hypersonic Flow Phenomena (P. M. Ligrani), Invited Plenary Paper, Third International Forum on Aerospace and Aeronautics (AEROFORUM 2023), San Diego, California, USA, December 11-13, 2023.

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165. Experimental Investigation of a Unique Upper Pressure Side Film Cooling Arrangement Supplied by Two Separate Plenums for a Transonic Squealer Turbine Blade Tip (G. Fulmer, P. M. Ligrani, H. Collopy, H. Xu, and M. Fox), Paper Number AIAA-2024-XXXX, 2024 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum), American Institute of Aeronautics and Astronautics, Hyatt Regency Orlando Hotel, Orlando, Florida, USA, January 8-12, 2024.