

**CURRICULUM VITAE**  
**DONALD KEITH HOLLINGSWORTH**

**EDUCATION:**

**Ph.D., Stanford University**, September, 1989, Mechanical Engineering.  
**M.S., North Carolina State University**, December, 1982, Mechanical Engineering.  
**B.S., North Carolina State University**, May, 1980, Mechanical Engineering,  
School of Engineering Honors Program.

**PROFESSIONAL EXPERIENCE:**

**8/2011 - Present:** Professor and Department Chair, Mechanical and Aerospace Engineering  
Department, University of Alabama in Huntsville

**9/98 – 8/2011:** Member of the faculty of the Department of Mechanical Engineering,  
University of Houston.  
Associate Department Chair (2009 – 2011)  
Associate Professor, Biomedical Engineering Program (1/2008 – 8/2011)  
Associate Professor (9/95 – 8/2011, tenured 9/95)  
Assistant Professor (9/89 – 8/95)

**9/84 - 9/89:** Research Assistant, Stanford University, Stanford, CA.

**6/82 - 8/84:** Research Project Manager, North Carolina Alternative Energy Corporation,  
Research Triangle Park, NC.

**5/79 - 6/82:** Research Assistant, North Carolina State University, Raleigh, NC.

**RECOGNITION OF TEACHING:**

**At the University of Houston:**

Outstanding Teacher Award, Cullen College of Engineering, 2011;  
Fellow of the Honors College (member of the inaugural class), 2010.  
University of Houston Faculty Award for Mentoring Undergraduate Research, 2009.  
El Paso Energy Corp. Faculty Achievement Award in Engineering, 2001.  
W. T. Kittinger Award, Cullen College of Engineering, 2000;  
(highest teaching award in the Cullen College).  
Outstanding Teacher Award, Cullen College of Engineering, 1999;  
Enron Teaching Excellence Award, University of Houston, 1997;  
(highest teaching award for the University.)  
Department of Mechanical Engineering "Professor of the Year" Award, 1991 and 1993.  
(Presented by the ASME Student Chapter and determined by student vote.)

## **RECOGNITION OF RESEARCH:**

Associate Fellow, American Institute of Aeronautics and Astronautics, 2015.

Fellow, American Society of Mechanical Engineers, 2009.

Herbert Allen Award from the South-Texas Section of ASME for "outstanding technical achievement by an engineer 35 years of age or younger," 1993.

### With Students Associated with Directed Research:

Research featured on the cover of *Heat Transfer Engineering*, October, 2007, Vol. 28, No. 10: "High-Speed Visualization of Two-Phase Flow in a Micro-Scale Pin-Fin Heat Exchanger," T. Cognata, D. K. Hollingsworth, & L. C. Witte.

The *Warren M. Rohsenow Prize* to M. J. Barrett (presenter) and D. K. Hollingsworth (advisor) for "best presentation in a technical session on heat transfer in gas turbine systems at the 1999 National Heat Transfer Conference." Awarded by the Gas Turbine and Heat Transfer Divisions of the ASME for presentation of the paper: "On the correlation of skin friction and heat transfer in turbulent boundary layers subjected to free-stream turbulence".

Research using liquid crystal thermography featured on the cover of *Parameters*, Cullen College of Engineering Alumni Magazine, Spring edition, 1999.

### While a graduate student:

Excellence in Presentation of a Technical Paper Award, Eighth International Heat Transfer Conference, Aug. 1986 for "Experiments on Mixed Convection from a Heated Cubical Element on an Adiabatic Channel Wall Using Multi-chromic Liquid Crystals and Digital Image Processing," D. K. Hollingsworth, F. Bejarano, A. Ortega & R. J. Moffat.

## **TEACHING:**

### At the University of Alabama in Huntsville:

MAE 342, Thermodynamics II (Junior)

MAE 643, Advanced Heat Transfer (Graduate)

MAE 746, Convection (Graduate)

Recurring Lecture in MAE 100 and MAE 200: "Introduction to Engineering Education and the MAE Department," 2011 – present.

Thermodynamics Review for the FE Exam, UAH College of Engineering, 2011.

### At the University of Houston:

MECE 2334, Thermodynamics I (Sophomore)

MECE 3363, Introduction to Fluid Mechanics (Junior)

MECE 4364, Heat Transfer (Senior)

MECE 4371, Thermo-Fluids Laboratory (Senior)

MECE 6333, Conduction and Radiation (Graduate, newly-created course)

MECE 6334, Convective Heat Transfer (Graduate)

MECE 7397, Graduate Experimental Methods (Graduate, newly-created course)

MECE 1100, Freshman Seminar: lecture "Introduction to The Thermal Sciences"  
as requested, 2001 - 2011.

Thermodynamics Review for the FE/EIT Exam, Cullen College Continuing Education  
Program, 1990 – 2011

Heat Transfer Review for the Principles and Practices Exam, Cullen College Continuing  
Education Program, 2002 – 2011.

"UH/NASA JSC Summer Design Partnership," Cullen College of Engineering; program  
co-director; Summer terms of 2000, 2001, and 2002.

**SERVICE:**

**At the University of Alabama in Huntsville:**

Department: Chair, Mechanical and Aerospace Engineering Department (2011 – present)

College: Member, College of Engineering Executive Committee (2011 – present)

University: Reappointment Committee, Dean of Engineering (2015)  
Panel of UAH Department Chairs for the Provost's academic  
administration training program (LEAD) (2014, 2015)  
Strategic Planning Exercise (2013)  
Proposal Lead for Aerospace and Energy Areas; Co-chair, Faculty  
Recruiting Task Force; Member, Proposal Evaluation Task Force

**At the University of Houston (selected service activities):**

Department: Associate Department Chair (2009 - 2011)  
Development & operation of Accelerated B.S. to Graduate Program (2001 – 2011)  
Director of Graduate Studies (2007 - 2009, and 1998 -2004)  
Director of Graduate Admissions (1995 - 1998)  
Honors Advisor (1991 - 2011)  
Graduate Affairs Committee (2007 - 2009, and 1993 - 2005)  
Undergraduate Affairs Committee (1989 - 93)  
Teaching Laboratory Committee (1990 - 2011)  
Search Committees: Thermal Science (2005 – 2007), Smart Systems (2005)  
Faculty Advisor for ASME student chapter (1992 - 95).

College: Committee to develop an Engineering Honors Program (2009)  
Graduate Standards Committee (2007- 2009, 1995 - 2004).  
Committee to develop the PhD program in Biomedical Engineering (2008).  
Committees for Teaching Awards (2006) and Effective Instruction (1991 - 94).

University: Elected Positions on University Governing Councils:  
Graduate and Professional Studies Council (2002-2003)  
University Research Council (1997 - 1998)  
Search committee for the Assoc. Vice President for Enrollment Services (2009).  
University Teaching Excellence Committee (1999 – 2002; chair, 2001-2002)  
Farfel Award Committee for the University's outstanding faculty member (2002)  
Shell Interdisciplinary Grant Selection Committee (1998)

New Instructional Technology Committee (1998)  
Provost's Task Force: Implementation of the SPEAK Test (June, 1997)

**To Professional Societies:**

ASME Journal of Heat Transfer

Associate Editor, January 2014 – December 2015.

Conference Organizational Committees:

ASME K-13 Multiphase Heat Transfer Committee, 2007 - present.

ASME Heat Transfer Visualization Committee, 1998 - 2001.

Organizing Committee for the Engineering Foundation Turbulent Heat Transfer Conference, Anchorage, Alaska, March 2001.

Session Chair Activities:

“Flow Boiling II,” Inter. Heat Transfer Conf., Washington D.C, August, 2010.

Sessions HT7-3 and HT7-7, “Boiling and Condensation I and II,” ASME Summer Heat Transfer Conference, July, 2009.

Session 7-5, “Enhancement Methods in Multiphase Heat Transfer,” ASME Summer Heat Transfer Conference, August, 2008.

Sessions 10-10-1: “Boiling Heat Transfer,” and 10-10-7: “Heat Transfer in Thin Films,” ASME IMECE, October, 2008.

“Surface Heat Transfer Gages and Particle Image Velocimetry,” 5th ASME/JSME Thermal Engineering Joint Conference, March, 1999.

“Advances in High-Heat-Flux Heat Transfer for Electronics,” 7<sup>th</sup> AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 1998.

“Heat Transfer in High Heat Flux Systems,” ASME Summer Heat Transfer Conference, Portland, Oregon, August, 1995.

“Heat Transfer II,” International Symp. on Engg Turbulence Modelling and Measurements, Dubrovnik, Yugoslavia, Sept., 1990.

**Unpublished reviews of journal articles for:**

ASME Journal of Heat Transfer,  
ASME Journal of Solar Engineering  
Exp. Thermal & Fluids Science  
International Gas Turbine Institute

ASME Journal of Fluids Engineering  
AIAA Journal  
Experiments in Fluids

**Unpublished reviews for grant proposals:**

National Science Foundation  
University of Houston Energy Laboratory  
University of Houston Research Initiation Program  
University of Houston Shell Interdisciplinary Research Program

**Service on National Science Foundation Proposal Review Panels:**

Major Research Instrumentation panel, April 29 - 30, 2004, Washington D. C.  
NSF / Sandia proposal review panel, June 29, 2006, Albuquerque, NM  
NSF proposal review panel, Nov. 9, 2009, Washington, D.C.  
NSF proposal review panel, April, 2011, Washington, D.C. (by Skype)

## **SUPERVISION OF RESEARCH:**

### **Current:**

John Willard, Ph.D. dissertation on computational modeling of a bubble in a large-aspect-ratio minichannel

### **Completed Doctorates:**

#### **At the University of Alabama in Huntsville:**

Khaled Al-Bhloul, Ph.D. dissertation: *Heat Transfer Enhancement Caused by Sliding Noncondensable Gas Bubbles in a Minichannel*, December, 2014.

#### **At the University of Houston:**

Ahmet Oncel, Ph.D. dissertation: *Heat Transfer Enhancement Caused by the Controlled Production of Sliding Vapor Bubbles in Laminar Subcooled Flow in a Narrow Channel*, May, 2011

A. Ozer, Ph.D. dissertation: *A Combined Photographic/Thermographic Study of Highly Subcooled Flow Boiling in a Narrow Channel*, December, 2010.

Xin Li, Ph.D. dissertation: *An Experimental Study of the Microlayer Thickness and Kinematics of a Sliding Vapor Bubble*, August, 2005.

M. J. Barrett, Ph.D. dissertation: *Skin Friction and Heat Transfer in Turbulent Boundary Layers Subjected to Small-scale Free-stream Turbulence*, August, 1998.

Y. Chin, Ph.D. dissertation: *An Experimental Study of Flow Boiling in a Narrow Channel: From Convection to Nucleate Boiling*, December, 1997, co-advised with L. C. Witte.

M. Balaji, Ph.D. dissertation: *An Experimental Study of the Turbulent Momentum and Thermal Boundary Layers Beneath a Two-Stream Mixing Layer*, October, 1997.

### **Completed Master of Science Degrees:**

#### **At the University of Houston:**

S. Natesh, M.S. thesis: *A Numerical Study of the Flow and Heat Transfer in the Near Field of a Cylindrical Bubble Moving in a Narrow Channel*, December, 2012.

A. Higgins, M.S. thesis: *Quantitative Image Analysis Applied to a Two-Phase Interconnected Microchannel Heat Exchanger*, August, 2010.

J. Robertson, M.S. thesis: *Measurement of Temperature and Work Output in a Swine Myocardium During Coronary Artery Occlusion*, December, 2008.

T. Cognata, M. S. thesis: *Flow Visualization and Thermal Performance of a Two-Phase Plate-Fin Micro Heat Exchanger*, August, 2008.

E. Daniel, M. S. thesis: *Transition from Boiling Onset to Fully Developed Nucleate Boiling in a Narrow Channel*, May, 2006.

M. Figueroa, M. S. thesis: *The Evolution of the Microlayer Thickness Above a Sliding Vapor Bubble*, December, 2005.

R. Subramaniam, M. S. thesis: *Correlating Skin Friction and Heat Transfer in Flows with Very High Free-Stream Turbulence Intensity*, October, 2001.

Q. Lu, M. S. thesis: *Single and Two-Phase Heat Transfer In A Micro-channel*, August, 2001, co-advised with L. C. Witte.

B. B. Bayazit, M. S. thesis: *A Thermographic Analysis of the Heat Transfer Mechanisms Generated by a Sliding Bubble*, December, 2000, co-advised with L. C. Witte.

L. R. Pate, M. S. thesis: *Investigation of Surface-tension-driven Flows on a Uniform Flux Surface*, December, 1999.

S. Miller, M. S. thesis: *Correlating Turbulent Boundary Layer Heat Transfer in the Presence of Free-Stream Turbulence*, November, 1999.

M. S. Lakshminarasimhan, M. S. thesis: *Boiling Incipience in Thin Channels*, August, 1999, co-advised with L. C. Witte.

C. H. Campbell, M. S. thesis: *An Evaluation of Infrared Thermography as Applied to Research in Boiling Heat Transfer*, March, 1999.

N. E. Dalrymple, M. S. thesis: *Quantitative Imaging of Boiling Fronts in Planar Jet-Impingement Convection*, December, 1995.

J. L. Drapp Hay, M. S. thesis, *Calibration of Thermochromic Liquid Crystals, thesis on detailed calibration of liquid crystal surfaces*, May, 1995.

M. J. Barrett, M. S. thesis: *The Numerical Investigation of a Turbulent Boundary Layer with an Elevated Free-stream Turbulence Intensity*, August, 1994.

N. M. Dukle, M. S. thesis: *Thermal Images of the Transition from Jet-Impingement Convection to Nucleate Boiling*, March, 1994.

C. A. Belbas, M. S. thesis: *Design and Qualification of a Heat Transfer Surface for Studies of High Turbulence*, August, 1993.

H. A. Bourgogne, M. S. thesis: *The Development of a Turbulent Boundary Layer Beneath a Two-Stream Mixing Layer*, December, 1991.

A. A. Watwe, M. S. thesis: *A Study of Nucleate Boiling Incipience Using Liquid Crystal Thermography*, August, 1991.

#### **Completed Master of Mechanical Engineering Design Projects (at U. Houston):**

J. G. Hinke, MME Design Project: *Design of the Dusting Apparatus Used in a Mars Radiator Characterization Experiment*, December, 2004

#### **Completed Undergraduate Honors or Senior Theses:**

##### **At the University of Alabama in Huntsville:**

W. S. King, *A Review and Assessment of Endocardial Convection Coefficients*, May, 2014.

##### **At the University of Houston:**

E. Franco, *FLUENT Modeling in Support of the Mars Radiator Characterization Experiment*, December, 2003.

A. Weaver, *Heat Transfer Analysis of a Biomedical Transport Container*, December, 2001.

S. Geffert, *A History of the Cold Chain: Problems in the Transport of Biological Materials*, May, 2001.

N. Rahim, *Liquid Crystal Imaging of High-Turbulence Heat Transfer*, June, 1998.  
T. Dutton, *Liquid Crystal Imaging of Surface-Tension-Driven Convection*, May, 1996.  
R. E. Martinez, *Development of a Cold-Wire Temperature Measurement System*, Dec., 1994.  
J. L. Drapp, *A Study in the Calibration of Chiral Nematic Liquid Crystals for Use in Liquid Crystal Thermography*, August, 1993.  
R. A. Nicol, *Topological Methods in Fluid Dynamics: The ABC Flow Case*, January, 1993.  
A. W. Smith, *Water Modeling of Quenching Tank*, December, 1991.

#### **CONSULTING ACTIVITIES:**

NASA Johnson Space Center, 2003  
Kodiak Technologies Corp., Houston TX, 2000-2009: Member, Corporate Advisory Board  
Igloo Products Corp., Houston, TX, 1998  
Valvtechnologies, Inc., Houston, TX, 1995  
Piping Technologies, Inc., Houston, TX, 1995  
Kinjet Technologies, Inc., Alvin, TX, 1990 - 1992.  
Becton Dickinson Inc., Research Triangle Park, NC, 1983.

#### **PROFESSIONAL ORGANIZATIONS:**

Registered Professional Engineer in Texas, 1993 -present.  
American Society of Mechanical Engineers (Fellow, 2009)  
American Institute of Aeronautics and Astronautics, 2012 – present  
American Institute of Engineering Education, 2012 - present

#### **PUBLICATIONS:**

##### **JOURNALS:**

1. Organized Motion in a High Reynolds Number Jet; G. Mungal & D. K. Hollingsworth, *Physics of Fluids A*, 1989, Vol. 1, No. 10, pp. 1615-1623.
2. The effect of concave surface curvature on the turbulent Prandtl number and the thermal law-of-the-wall; D. K. Hollingsworth, W. M. Kays & R. J. Moffat, *J. Exp. Thermal & Fluid Science*, 1992, Vol. 5, pp. 299-306.
3. Liquid crystal thermal images of surface temperature during incipient pool boiling; A. A. Watwe & D. K. Hollingsworth, *J. Exp. Thermal & Fluid Science*, 1994, Vol. 9, pp. 22-33.
4. The Development of a Turbulent Boundary Layer In High Free-Stream Turbulence Produced by a Two-Stream Mixing Layer; D. K. Hollingsworth & H. A. Bourgoigne, *J. Exp. Thermal & Fluid Science*, 1995, Vol. 11, pp. 210-222.
5. A Comparison of Trichromic Systems for Use in the Calibration of Polymer-Dispersed Thermochromic Liquid Crystals; J. L. Hay & D. K. Hollingsworth, *J. Exp. Thermal and Fluid Science*, 1996, Vol. 12, pp. 1-12.

6. Liquid Crystal Images of the Transition from Jet-Impingement Convection to Nucleate Boiling, Part I: Monotonic Distribution of the Convection Coefficient; N. M. Dukle & D. K. Hollingsworth, *J. Exp. Thermal & Fluid Science*, 1996, Vol. 12, pp. 274-287.
7. Liquid Crystal Images of the Transition from Jet-Impingement Convection to Nucleate Boiling, Part II: Nonmonotonic Distribution of the Convection Coefficient; N. M. Dukle & D. K. Hollingsworth, *J. Exp. Thermal & Fluid Science*, 1996, Vol. 12, pp. 288-297.
8. Calibration of Micro-encapsulated Liquid Crystals Using Hue Angle and a Dimensionless Temperature; J. L. Hay & D. K. Hollingsworth, *J. Exp. Thermal & Fluid Science*, 1998, Vol. 18, pp 251-257.
9. On the Calculation of Length Scales for Turbulent Heat Transfer Correlation; M. J. Barrett & D. K. Hollingsworth, *ASME J. Heat Transfer*, Oct., 2001, Vol. 123, pp 878-883.
10. Convective Heat Transfer In Vertical Asymmetrically Heated Narrow Channels; Y. Chin, M. Lakshminarasimhan, Q. Lu, D. K. Hollingsworth, & L. C. Witte, *ASME J. Heat Transfer*, December, 2002, Vol. 124, 1019-1025.
11. Heat Transfer in Turbulent Boundary Layers Subjected to Free-stream Turbulence, Part I: Experimental Results; M. J. Barrett & D. K. Hollingsworth, *ASME J. of Turbomachinery*, April, 2003, Vol. 125, pp 232-241.
12. Heat Transfer in Turbulent Boundary Layers Subjected to Free-stream Turbulence, Part II: Analysis and Correlation; M. J. Barrett & D. K. Hollingsworth, *ASME J. of Turbomachinery*, April, 2003, Vol. 125, pp 242-251.
13. Heat Transfer Enhancement Caused by Sliding Bubbles; B. B. Bayazit, D. K. Hollingsworth & L. C. Witte, *ASME J. Heat Transfer*, June, 2003, Vol. 125, No. 3, pp. 503-509.
14. Correlating Friction Velocity in Turbulent Boundary Layers Subjected to Free-stream Turbulence; M. J. Barrett & D. K. Hollingsworth, *AIAA Journal*, August 2003, Vol. 41, No. 8, pp. 1444-1451.
15. Fully Developed Nucleate Boiling in Narrow Vertical Channels; M. Lakshminarasimhan, Q. Lu, Y. Chin, D. K. Hollingsworth, L. C. Witte, & ASME *J. Heat Transfer*, August, 2005, Vol. 127, No. 8, pp. 941-944.
16. Reduction in the Emittance of Thermal Radiator Coatings Caused by the Accumulation of Simulated Martian Dust; D. K. Hollingsworth, L. C. Witte, J. G. Hinke, & K. Hurlbert, *Applied Thermal Engineering*, December, 2006, vol. 26, pp. 2383-2392.
17. The Thickness of the Liquid Microlayer Between a Cap-Shaped Sliding Bubble and a Heated Wall: Experimental Measurements; Xin Li, D. K. Hollingsworth, L. C. Witte, *ASME J. Heat Transfer*, September, 2006, Vol. 128, pp. 934-944.
18. High-Speed Visualization of Two-Phase Flow in a Micro-Scale Pin-Fin Heat Exchanger; T. Cognata, D. K. Hollingsworth, & L. C. Witte, *Heat Transfer Engineering*, October, 2007, Vol. 28, No. 10, pp. 861-869 and featured on the cover of the volume.



19. Transition from Boiling Onset to Fully Developed Nucleate Boiling in a Narrow Vertical Channel; E. Daniel, D. K. Hollingsworth & L. C. Witte, *Heat Transfer Engineering*, October, 2007, Vol. 28, No. 10, pp. 885-894.
20. Vapor Bubble Rise Under a Heated Inclined Plate; Xin Li, D. K. Hollingsworth, & L. C. Witte, *J. Exp. Thermal & Fluid Science*, November, 2007, Vol. 32, No. 2, pp. 529-544.
21. The Thickness of the Liquid Microlayer Between a Cap-Shaped Sliding Bubble and a Heated Wall: Comparison of Models to Experimental Data; D. K. Hollingsworth, Xin Li, L. C. Witte, *ASME J. Heat Transfer*, November 2008, Vol. 130, No. 111501.
22. Enhancement of Heat Transfer Behind Sliding Bubbles; D. Keith Hollingsworth, Larry C. Witte, Marcelino Figueroa, *ASME J. Heat Transfer, special edition, Dec. 2009, Vol 131, No. 121005-1*.
23. Imaging of Surface-Tension-Driven Convection Using Liquid Crystal Thermography; T. W. Dutton, L. R. Pate & D. K. Hollingsworth, *ASME J. Heat Transfer, Dec. 2010, Vol 132, No. 121601*.
24. The effect of sliding bubbles on nucleate boiling of a subcooled liquid flowing in a narrow channel; Arif Ozer, Ahmet Oncel, D. K. Hollingsworth, & L. C. Witte, *Int. J. Heat and Mass Transfer, 2011, Vol 54, pp. 1930-1940*.
25. A Method of Concurrent Thermographic-Photographic Visualization of Flow Boiling in a Minichannel; Arif Ozer, Ahmet Oncel, D. K. Hollingsworth, & L. C. Witte, *J. Exp. Thermal & Fluid Science* November, 2011, Vol. 35, No. 8, pp. 1522-1529.
26. Observations of Bubble Shape and Confinement in Diabatic Two-phase Flow in a Minichannel; Khaled E. Albahloul, D. K. Hollingsworth, *Int. J. Heat and Mass Transfer, 2015, Vol 83, pp. 200-211*.
27. Vapor Bubble Approaching a Superheated Wall; Mohammad W. Akhtar, Stanley J. Kleis, D. K. Hollingsworth, *Int. J. Heat and Mass Transfer, 2015, Vol 83, pp. 809-819*.

***In Preparation:***

28. A Model of the Heat Transfer Behind Sliding Bubbles in a Highly Subcooled Flow in a Narrow Channel, Khaled E. Albahloul, A. Ozer, & D. K. Hollingsworth, *in preparation for the Int. J. Heat and Mass Transfer*.

**KEYNOTE LECTURES AND INVITED CONFERENCE PRESENTATIONS:**

1. Surface Effects in Boiling; D. K. Hollingsworth, article is one section of the proceedings of an invited panel discussion: "Unanswered Questions and Technological Limitations Related to the Characterization of Material Interfaces in Heat Transfer Research", Proceedings of the ASME Winter Annual Meeting, Chicago, November 1994.
2. Applications of Liquid Crystal Thermography to Boiling Heat Transfer; D. K. Hollingsworth, J. L. Hay and N. E. Dalrymple, an invited paper and keynote lecture,

International Conference on Heat Transfer with Phase Change, Volume 1, pp. 215-224, Kielce, Poland, Dec. 8-10, 1996.

3. Applications of Liquid Crystal Thermography to Flow Boiling Heat Transfer in Mini-Channels; D. K. Hollingsworth, an invited paper and keynote lecture. Proceedings of the 5<sup>th</sup> International Boiling Heat Transfer Conference, May 4-8, Montego Bay, Jamaica, 2003, keynote lecture VIII.
4. Liquid Crystal Imaging of Flow Boiling in Minichannels; D. K. Hollingsworth, an invited paper and keynote address. Proceedings of the 2<sup>nd</sup> International Conference on Microchannels and Minichannels, Rochester, NY, June 17-19, 2004, Number ICMM2004-2320, pp. 57-66.
5. The Effect of Martian dust on Radiator Performance; D. K. Hollingsworth, an invited paper presented at the NASA Contamination and Coatings Workshop, August 3 – 4, 2005.

#### **REFEREED CONFERENCE PROCEEDINGS:**

1. Verification of Building Energy Analysis Simulations Using an Existing Building Performance Data Base; D. K. Hollingsworth, F. Y. Sorrell & T. Luckenbauch, Proceedings of the American Council for an Energy Efficient Economy, Santa Cruz, Aug. 1984. (presented by D. K. Hollingsworth)
2. The Measurement and Prediction of Heat Transfer in a Turbulent Boundary Layer in Water; D. K. Hollingsworth, W. M. Kays & R. J. Moffat, Proceedings of the 7th International Symposium on Turbulent Shear Flows, 1989, pp. 20.4.1-20.4.6. (presented by D. K. Hollingsworth)
3. Application of Liquid Crystal Thermography to the Measurement of Surface Temperature in a Complex Flow; D. K. Hollingsworth, A. Boehman, E. Smith, & R. J. Moffat, ASME Collected Papers in Heat Transfer, 1989 HTD-Vol 123, pp. 35-42; presented in posted form at the 1989 ASME Heat Transfer Division Winter Annual Meeting. (presented by D. K. Hollingsworth)
4. The effect of concave surface curvature on the turbulent Prandtl number and the thermal law-of-the-wall; D. K. Hollingsworth, W. M. Kays & R. J. Moffat, Proceedings of the International Symposium on Engineering Turbulence Modeling and Measurements, Dubrovnik, Yugoslavia, Sept., 1990, pp. 759-768. (presented by D. K. Hollingsworth)
5. Thermal images of the transition from bubble-forced convection to nucleate boiling; A. Watwe & D. K. Hollingsworth, National Heat Transfer Conf., San Diego, *AIChE Symp.*, 1992, Vol. 88, pp. 1-9. (presented by D. K. Hollingsworth)
6. Thermal images of the transition from natural convection to nucleate boiling; A. Watwe & D. K. Hollingsworth, National Heat Transfer Conf., San Diego, *AIChE Symp.*, 1992, Vol. 88, pp. 10-17. (presented by D. K. Hollingsworth)

7. The Behavior of a Boiling Front in Jet-Impingement Boiling; N. E. Dalrymple, N. M. Dukle & D. K. Hollingsworth, Proceedings of the ASME/JSME Thermal Engineering Joint Conf., Maui, March 1995, Vol. 2, pp. 339-346. (presented by N. E. Dalrymple)
8. An Experimental Investigation of Flow Boiling Incipience in a Narrow Rectangular Channel Using Thermochromic Liquid Crystals; Y. Chin, L. C. Witte & D. K. Hollingsworth, Proceedings of the 7th AIAA/ASME Joint Thermophysics Conf., 1998. (presented by L. C. Witte)
9. A Study of Convection in a Asymmetrically Heated Duct Using Liquid Crystal Thermography; Y. Chin, D. K. Hollingsworth & L. C. Witte, Vol. 2., pp. 63-70, Proceedings of the 7th AIAA/ASME Joint Thermophysics Conf., 1998. (presented by D. K. Hollingsworth)
10. Experimental Investigation of Heat Transfer in a Three-Dimensional Boundary Layer Beneath a Mixing Layer; M. Balaji & D. K. Hollingsworth, Proceedings of the 7th AIAA/ASME Joint Thermophysics Conf., 1998. (presented by D. K. Hollingsworth)
11. On the Calculation of Length Scales for Turbulent Heat Transfer Correlation; M. J. Barrett & D. K. Hollingsworth, No. AJTE99/6256, Proceedings of the 5th ASME/JSME Joint Thermal Engineering Conf., San Diego, California, March, 1999. (presented by D. K. Hollingsworth)
12. On the Correlation of Heat Transfer in Turbulent Boundary Layers Subjected to Free-Stream Turbulence; M. J. Barrett & D. K. Hollingsworth, No. NHTC99-76, Proceedings of the 33rd National Heat Transfer Conf., Albuquerque, New Mexico, August, 1999 (presented by M. J. Barrett).
13. Boiling Incipience in Narrow Channels; M. S. Lakshminarasimhan, Y. Chin, D. K. Hollingsworth & L. C. Witte, Proceeding of the Int. Mech. Engg. Congress and Exposition, Orlando, Florida, November, Vol. 336, No. 2, pp. 213-220, 2000. (presented by D. K. Hollingsworth)
14. Liquid Crystal Imaging of Surface-Tension-Driven Convection; T. W. Dutton, L. R. Pate & D. K. Hollingsworth, Proceeding of the Int. Mech. Engg. Congress and Exposition, Orlando, Florida, November, 2000. (presented by D. K. Hollingsworth)
15. Heat Transfer Enhancement Caused by Sliding Bubbles; B. B. Bayazit, D. K. Hollingsworth & L. C. Witte, Proceedings of the 35th National Heat Transfer Conf., No. NHTC01-11651, Anaheim, California, June, 2001. (presented by D. K. Hollingsworth)
16. Correlating Friction Velocity in Turbulent Boundary Layers Subjected to Free-stream Turbulence; M. J. Barrett & D. K. Hollingsworth, No. AIAA-2002-2863, Proceedings of the AIAA Summer Conf., St. Louis, 2002. (presented by M. J. Barrett)
17. Heat Transfer Between a Sliding Vapor Bubble and an Electrically Heated Surface; L. C. Witte, D. K. Hollingsworth, M. Figueroa, B. B. Bayazit, Proceedings of the 5<sup>th</sup> International Boiling Heat Transfer Conference, May 4-8, Montego Bay, Jamaica, 2003, Session VII (presented by L. C. Witte).

18. The Effect of Martian dust on Radiator Performance; D. K. Hollingsworth, L. C. Witte, J. Hinke, & K. Hurlbert, Proceedings of the ASME Summer Heat Transfer / Fluids Engineering Division Joint Conference, ASME HT-FED04-56577, July 11-15, 2004, Charlotte, NC. (presented by D. K. Hollingsworth)
19. Measurement of the Thickness of the Liquid Microlayer Between a Sliding Bubble and a Heated Wall; Xin Li, D. K. Hollingsworth, L. C. Witte, Proceedings of the ASME Summer Heat Transfer Conference, ASME HT-2005-72349, July 17-22, 2005, San Francisco, CA. (presented by D. K. Hollingsworth)
20. High-Speed Visualization of Two-Phase Flow in a Micro-Scale Pin-Fin Heat Exchanger; T. Cognata, D. K. Hollingsworth, L. C. Witte, 6th International Conference on Boiling Heat Transfer, May 2006, proceedings on CDROM (presented by D. K. Hollingsworth).
21. Transition from Boiling Onset to Fully Developed Nucleate Boiling in a Narrow Vertical Channel; E. Daniel, D. K. Hollingsworth, L. C. Witte, 6th International Conference on Boiling Heat Transfer, May 2006, proceedings on CDROM (presented by D. K. Hollingsworth)
22. Enhancement of Heat Transfer Behind Sliding Bubbles; Marcelino Figueroa, D. Keith Hollingsworth, Larry C. Witte, ASME-JSME Thermal Engineering Summer Heat Transfer Conference, Vancouver B.C., July, 2007, HT2007-32400, proceedings on CDROM (presented by D. K. Hollingsworth).
23. The Thickness of the Liquid Microlayer Between a Cap-Shaped Sliding Bubble and a Heated Wall: Comparison of Models to Experimental Data; Xin Li, D. K. Hollingsworth, L. C. Witte, ASME Int. Mechanical Engineering Congress, Seattle, WA, November, 2007 IMECE2007-44028, proceedings on CDROM (presented by D. K. Hollingsworth).
24. A Method for Concurrent Thermographic-Photographic Visualization of Flow Boiling in a Minichannel; A. Ozer, A. Oncel, D. K. Hollingsworth, L.C. Witte, International Heat Transfer Conference, Washington D.C., August, 2010, IHTC14-23107, proceedings on CDROM (poster presentation, A. Ozer and D. K. Hollingsworth).
25. The Onset of Nucleate Boiling of a Subcooled Liquid Flowing in a Narrow Channel; A. Ozer, A. Oncel, D. K. Hollingsworth, L.C. Witte, International Heat Transfer Conference, Washington D.C., August, 2010, IHTC14-22689, proceedings on CDROM (poster presentation, A. Ozer and D. K. Hollingsworth).
26. Highly Subcooled Flow Boiling: A Model for Estimating Heat Transfer Behind Sliding Bubbles in a Narrow Channel; A. Ozer, D. K. Hollingsworth, L.C. Witte, ASME Summer Heat Transfer Conference, Puerto Rico, July, 2012, HT2012-58031, proceedings on CDROM (presented by D. K. Hollingsworth).
27. Comparing the Enhancement of Heat Transfer Caused by Sliding Gas Bubbles and by Sliding Vapor Bubbles in Subcooled Flow in a Minichannel; K. E. Albahloul, A. Ozer, D. K. Hollingsworth, L.C. Witte, ASME Summer Heat Transfer Conference, Minneapolis MN, July, 2013, HT2013-17070, proceedings on CDROM (presented by D. K. Hollingsworth).

28. Effects of Double Wall Cooling Configuration and Conditions on Performance of Full Coverage Effusion Cooling; N. Rogers, Z. Ren, W. Buzzard, B. Sweeney, N. Tinker, P. Ligrani, D. K. Hollingsworth, F. Liberatore, R. Patel, H-K. Moon; Proceedings of ASME Turbo Expo 2016: Turbomachinery Technical Conference and Exposition GT2016, June 13-17, 2016, Seoul, South Korea.
29. Numerical Investigation of Flow Structure and Heat Transfer Produced by a Single Highly Confined Bubble in a Pressure-driven Channel Flow; J. R. Willard, D. K. Hollingsworth; ASME 2016 Summer Heat Transfer Conference, HT2016, July 10-14 2016, Washington, D.C.

**NON-REFEREED NATIONAL CONFERENCE PRESENTATIONS:**

1. Experiments on Mixed Convection from a Heated Cubical Element on an Adiabatic Channel Wall Using Multi-chromic Liquid Crystals and Digital Image Processing; D. K. Hollingsworth, F. Bejarano, A. Ortega & R. J. Moffat, poster presented at the Eighth International Heat Transfer Conference, Aug. 1986.
2. Organized Motion in a High Reynolds Number Jet; G. Mungal & D. K. Hollingsworth, presented in poster form, 41st Meeting of the American Physical Society Fluid Dynamics Division, Nov. 1988;
3. Surface temperature transients during the incipience of nucleate pool boiling; A. Watwe, & D. K. Hollingsworth, presented in short video competition, 44th Meeting of the American Physical Society Fluid Dynamics Division, Nov. 1991.
4. The transition from bubble-forced convection to nucleate boiling; A. Watwe, & D. K. Hollingsworth, presented in poster form, 44th Meeting of the American Physical Society Fluid Dynamics Division, Nov. 1991.
5. Surface temperature distributions during the incipience of nucleate boiling; A. Watwe, & D. K. Hollingsworth, 44th Meeting of the American Physical Society Fluid Dynamics Division, Nov. 1991. (presented by student: A. Watwe)
6. The development of a turbulent boundary layer beneath a two-stream mixing layer; H. Bourgogne & D. K. Hollingsworth, 44th Meeting of the American Physical Society Fluid Dynamics Division, Nov. 1991. (presented by student: H. Bourgogne)
7. The Effect of Martian Dust on Thermal Radiators; D. K. Hollingsworth, L. C. Witte, J. Hinke, & K. Hurlbert, poster HLS46 at the Habitation 2004 National Conference, Orlando Florida, January 4-7, 2004. (presented by D. K. Hollingsworth)

**OTHER NON-REFEREED PUBLICATIONS:**

1. The Use of a Flat-Plate Current Meter in Nearshore Flows; D. K. Hollingsworth, M.S. thesis advised by F. Y. Sorrell, and T. B. Curtin, UNC Sea Grant College Pub. No. UNC-SG-WP-84-5, 1982.
2. Observations of the Effects of High Free-Stream Turbulence Levels on the Heat Transfer to a Concavely Curved Turbulent Boundary Layer; D. K. Hollingsworth, P. L. Johnson, J. P.

Johnston, and R. J. Moffat, Report No. HMT-39, Thermosciences Division, Dept. of Mech. Eng., Stanford University, April 1989.

3. Measurement and Prediction of the Turbulent Thermal Boundary Layer in Water on Flat and Concave Surfaces; D. K. Hollingsworth, Ph.D. dissertation advised by W. M. Kays and R. J. Moffat, Report No. HMT-41, Thermosciences Div., Dept. of Mech. Eng., Stanford Univ., Sept. 1989.
4. "Liquid Crystal Thermography"; D. K. Hollingsworth, cover story for *Parameters*, Cullen College of Engineering Alumni Magazine, Spring edition, 1999.

#### **CITATIONS IN BOOKS AND TREATISES:**

1. *Turbulent Prandtl Number-Where are We? - The 1992 Max Jakob Memorial Award Lecture* by W. M. Kays. Appears in article form in *ASME J. Heat Transfer*, 1994, Vol 116, pp 284 - 295. Results for the turbulent Prandtl number in water boundary layers from my Ph.D. dissertation (1989) are shown and discussed.
2. *Convective Heat and Mass Transfer*, 3<sup>rd</sup> Ed. (1993) and 4<sup>th</sup> Ed. (2004), by W. M. Kays, M. E. Crawford, and B. Weigand (4<sup>th</sup> Ed.), McGraw-Hill. Included in the chapter "Heat transfer: the turbulent boundary layer" of this popular graduate-level text are results from my Ph.D. dissertation (1989) that include a correlation for high-Prandtl-number heat transfer from the flat plate and graphs of experimental data. A complete data set was printed in an appendix of the third edition.
3. "Advances in Heat Flux Measurements", T. Diller, author, contained in *Advances in Heat Transfer*, Vol. 23, Academic Press Inc., 1993, pp. 279 - 368. This review article includes a description of the application of liquid crystal imaging to boiling and convection (based on research with Watwe, 1991).
4. *Turbulent Flows*, by Stephen B. Pope, Cambridge University Press. 1<sup>st</sup> Ed., Oct. 16, 2000, page 4, Figure 1.1, high-Reynolds-number jet image from Mungal and Hollingsworth, *Phys. of Fluids*, 1989.
5. *Engineering Data Book III*, by John R. Thome, published on-line by Wolverine Tube Inc., two videos from "High-Speed Visualization of Two-Phase Flow in a Micro-Scale Pin-Fin Heat Exchanger" released in 2006 for inclusion in Chapter 1, Video Gallery of Flow Phenomena.

#### **INTELLECTUAL PROPERTY:**

1. "Dust Distributor" filed with NASA Johnson Space Center and University of Houston, Oct. 21, 2004. Intellectual Property resulting from NASA Grant NAG9-1421. Innovators: D. K. Hollingsworth, L. C. Witte, and Kathryn Hurlbert (NASA JSC).
2. NASA Technical Brief Award: Dust Distributor, MSC-23944-1 to D. K. Hollingsworth, L. C. Witte, and Kathryn Hurlbert; NASA Inventions and Contributions Board, Nov. 28, 2011.

**SEMINARS NOT ASSOCIATED WITH NATIONAL OR INTERNATIONAL CONFERENCES:**

1. Heat Transfer Measurement Using Liquid Crystal Surfaces and Color Digital Image Processing; Stanford Thermosciences Division Affiliates Conf., Jan. 1986.
2. The Effects of Grid-Generated Turbulence on Concave Turbulent Boundary Layers; D, K. Hollingsworth & P. L. Johnson, Stanford Thermosciences Division Affiliates Conf., Jan. 1988.
3. Heat Transfer in Turbulent Water Boundary Layers; Heat Transfer and Turbulence Mechanics Seminar Series, Stanford University, Nov. 1988.
4. The Turbulent Thermal Boundary Layer in Water on a Concave Surface; Dept. of Mech. Eng. Seminar Series, University of Houston, Nov. 1990.
5. Experimental studies of high free-stream turbulence; University of Houston Energy Laboratory Seminar Series, University of Houston, Dec. 1991.
6. Presentation and panel discussion on "Reshaping the University of Houston"; Scholarship and Community Conference, University of Houston, Sept., 1992.
7. Thermal images of transitions from convection to nucleate boiling; Univ. of Houston Energy Laboratory Seminar Series, Univ. of Houston, March, 1993.
8. Quantitative thermal imaging of a boiling front; Mechanical Engineering Seminar Series, University of Houston, October, 1995.
9. Quantitative thermal imaging of a boiling front; invited seminar, Mechanical Engineering Department, Rice University, October, 1995.
10. Liquid crystal imaging of surface-tension-driven convection; Non-Linear Physics Seminar Series, University of Houston, April, 1997.
11. Heat transfer in boundary layers with high free-stream turbulence; Mechanical Engineering Seminar Series, University of Houston, fall semester, 1997.
12. Presentation and panel discussion: "The Role of Research in Undergraduate Education"; Scholarship and Community Conference, University of Houston, Sept., 1997.
13. Liquid Crystal Thermography and Its Application to Heat Transfer Research; Meeting of Engineering Committee Chairs, Houston Engineering & Scientific Society, Sept. 7, 2000.
14. Visualization and Measurement of Boiling Heat Transfer Using Liquid Crystal Thermography; Mechanical Engineering Seminar Series, University of Arizona, August, 2001.
15. Progress Update for the Mars Radiator Characterization Experiment; Thermal Science Group Meeting, Crew and Thermal Systems Division, Johnson Space Center, Nov. 7, 2003.
16. The Effect of Martian Dust on Thermal Radiators; NASA Advanced Life Support Group, Johnson Space Center, August 12, 2004.

17. Sliding Bubbles: Heat Transfer Rates and Bubble Dynamics, Mechanical Engineering Seminar Series, Rensselaer Polytechnic Institute, September, 2009.
18. Sliding Bubbles: Heat Transfer Rates and Bubble Dynamics, Seminar at University of Alabama-Huntsville, April, 2011.
19. Sliding Bubbles in Confined Rectangular Channels, Invited seminar at the University of Maryland, Oct. 18, 2013.
20. Sliding Bubbles in Confined Rectangular Channels, Invited seminar at the University of Central Florida, March 6, 2015.

**FUNDING FOR RESEARCH AND EDUCATION PROJECTS:**

**Government Grants:**

**At the University of Houston:**

1. "Visualization of Surface Temperature Distributions in Incipient Boiling Using Liquid Crystal Thermography," PI: D. K. Hollingsworth, National Science Foundation Research Initiation Award; June, 1991 - May, 1993.
2. "Visualization of Surface Temperature Distributions in Jet Impingement Boiling Using Liquid Crystal Thermography," PI: D. K. Hollingsworth, Texas Higher Education Coordinating Board - Advanced Research Program; January, 1992 - August, 1993.
3. "Convection and Boiling in Thin Channels," PI: D. K. Hollingsworth, Co-PI: L. C. Witte, Texas Higher Education Coordinating Board - Advanced Research Program; January, 1994 - December, 1995.
4. "A Study of High Free-Stream Turbulence for the Gas Turbine Industry," PI: D. K. Hollingsworth, Texas Higher Education Coordinating Board - Advanced Technology Program; January, 1996 - December, 1997.
5. "Convection and Boiling in Narrow Channels," PI: D. K. Hollingsworth, Co-PI: L. C. Witte, National Science Foundation; August, 1997 - July, 2000.
6. "Mars Radiator Characterization Experimental Program," PI: L. C. Witte, Co-PI: D. K. Hollingsworth, NASA (JSC), May, 2002 – August, 2004.
7. "Development of a Two-Phase Microscale Heat Exchanger," PI: D. K. Hollingsworth, Co-PI: L. C. Witte, Texas Higher Education Coordinating Board - Advanced Technology Program; January, 2004 - December, 2005.
8. "Flow Boiling of a Refrigerant-based Nanofluid in Mini-Channels," PI: D. K. Hollingsworth, Texas Higher Education Coordinating Board - Advanced Research Program; May, 2006 - January, 2009 (with extension).
9. "Aerospace Workforce Innovation Network," PI: K. Grigoriadis, Co-PI: D. K. Hollingsworth, M. Franchek, P. Sharma, G. Song, D. Zimmerman, Texas Workforce Commission, September, 2007 – August, 2009.



10. "Scholarships for the Accelerated B.S./Graduate (FastGrad) Degree in Engineering," PI: K. Grigoriadis, Co-PI: D. K. Hollingsworth, M. Franchek, M. Harold, H. Parsaei, NSF, September, 2007 – August, 2012.
11. "A Combined Photographic/Thermographic Study of Subcooled Boiling in a Narrow Channel," PI: D. K. Hollingsworth, Co-PI: L. C. Witte, NSF, September, 2009 – August, 2012.

**At the University of Alabama in Huntsville:**

12. "Development of the UAH TS/SS/WT (TranSonic/SuperSonic/Wind Tunnel) for Advanced Aerospace and Aeropropulsion Research," PI: Philip Ligrani; Co-PI: D. K. Hollingsworth, Robert Frederick, Richard Tyson, and Kader Frendi, October, 2015 to September 2016, Alabama Department of Commerce.

**Industrial Support:**

**At the University of Houston:**

1. "Water Modelling of a Quenching Tank, Phase I - Convection Optimization", Cameron Iron Works Inc.; PIs: D. K. Hollingsworth and S. J. Kleis; January, 1991 - Sept., 1991.
2. "Design of an Abrasive-Flow Venturi Mixing Valve," PI: D. K. Hollingsworth, Kinjet Incorporated; June, 1991 - August, 1991.
3. "Research Experience for Jillian Robertson at Texas Heart Institute," PI: D. K. Hollingsworth, Texas Heart Institute via grant from the US Army, May, 2006 – August, 2007.

**University Grants:**

**At the University of Houston:**

1. "Measurement of Liquid-Solid Contact in Boiling Using Liquid Crystal Thermography," PI: D. K. Hollingsworth, University of Houston Research Initiation Grant; March, 1990 - August, 1990.
2. "Convective Heat Transfer in the Presence of High Free-Stream Turbulence," PI: D. K. Hollingsworth, University of Houston Energy Laboratory; June, 1991 - August, 1991.
3. "An Experimental Investigation of High-Turbulence Heat Transfer," PI: D. K. Hollingsworth, University of Houston Institute for Space Systems Operations; June, 1992 - August, 1992.
4. "Enhancement of Heat Transfer by Sliding Bubbles," University of Houston Energy Laboratory, PI: D. K. Hollingsworth, Co-PI: L. C. Witte; June, 1993 - August, 1993.
5. "Liquid Crystal Imaging of Surface-Driven Benard Convection," PI: D. K. Hollingsworth, University of Houston Institute for Space Systems Operations; June, 1993 - August, 1993.

6. "Thermal Science Issues in the Design and Testing of Artificial Hearts and Heart-Assist Devices," PI: D. K. Hollingsworth, University of Houston Energy Laboratory; January, 1995 - May, 1995.
7. "Thermal Visualization of Boiling Incipience on an Enhanced Boiling Surface in Forced Convection," PI: D. K. Hollingsworth, University of Houston Energy Laboratory; June, 1996 – Aug., 1996.
8. "The Effect of Martian Dust on Radiator Performance," PI: D. K. Hollingsworth, University of Houston Inst. for Space Systems Operations; June, 2005 - August, 2005.

**At the University of Alabama in Huntsville:**

9. "Computational Study of Heat Transfer Due to Sliding Bubbles in a Minichannel," PI: D. K. Hollingsworth, University of Alabama Huntsville RIF Grant; May 1, 2014 – April 30, 2015.