


United States Nuclear Regulatory Commission Official Hearing Exhibit	
In the Matter of:	Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)
	ASLBP #: 07-858-03-LR-BD01
	Docket #: 05000247   05000286
	Exhibit #: NYS000295-00-BD01
	Admitted: 10/15/2012
	Rejected: Other:
	Identified: 10/15/2012
	Withdrawn: Stricken:

NYS000295  
Submitted: December 22, 2011  
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Dr. Richard T. Lahey

## VITA

### Dr. Richard T. Lahey, Jr.

*The Edward E. Hood Professor Emeritus of Engineering*

Rensselaer Polytechnic Institute

Troy, New York

#### Education

B.S. Marine Engineering-1961, U.S. Merchant Marine Academy  
M.S. Mechanical Engineering-1964, Rensselaer (RPI)  
M.E. Engineering Mechanics-1966, Columbia University  
Ph.D. Mechanical Engineering-1971, Stanford University

#### Professional Experience

7/61 - 9/61 Cities Service Company, New York, New York

Third Assistant Engineer - Operating Engineer on "jumbo" tanker, S/S Fort Hoskins also had responsibility for maintenance of all electrical equipment.

9/61 - 8/64 Knolls Atomic Power Laboratory, Schenectady, NY

Engineer - Various assignments on advanced naval nuclear submarine (S5G) design.

Thermal Development Group - Experimental work on DNB and hydrodynamic instability.

Fluid Systems Group - Systems design and documentation.

Safety Analysis Group - Analytical investigation of hypothetical accident conditions development of analog and digital computer models.

9/64 - 6/66 Columbia University, New York, New York

Research Assistant - University research in the area of biomechanics (blood flow, pulmonary mechanics, etc.)

8/61 - 8/67 U.S. Navy

Naval Officer - USNR

7/66 - 6/71 General Electric, San Jose, California

Principal Development Engineer - Responsible for experimental and analytical investigations in two-phase flow and boiling heat transfer phenomena, including: hydrodynamic stability, subchannel analysis, CHF and Pressure drop.

6/71 - 6/72 General Electric Company, San Jose, California

Manager, Heat Transfer Mechanisms - Responsible for applied research in the area of subchannel analysis, transient analysis and detailed Boiling Water Nuclear Reactor (BWR) heat transfer mechanisms.

6/72 - 11/73 General Electric Company, San Jose, California

Manager, Core Development - Responsible for all non-safety related thermal-hydraulic development work in support of the boiling water nuclear reactor.

11/73 - 10/75 General Electric Company, San Jose, California

Manager, Core and Safety Development - Responsible for all heat transfer and fluid flow and reactor physics development work in support of the boiling water nuclear reactor. Responsible for all foreign and domestic safety R&D programs.

10/75 - 6/87 Rensselaer Polytechnic Institute, Troy, New York

Chairman, Department of Nuclear Engineering & Science - Teaching, research and management of academic department concerned with nuclear technology.

5/87 - 4/89 Rensselaer Polytechnic Institute, Troy, New York

Professor, Department of Nuclear Engineering and Engineering Physics, and, Professor, Department of Chemical Engineering - University teaching and research.

4/89 - Present, Rensselaer Polytechnic Institute, Troy, New York

***The Edward E. Hood, Jr. Professor of Engineering*** (4/89-9/08 ;**Emeritus** 9/08-Present), Department of Mechanical, Aerospace & Nuclear Engineering and, Chemical Engineering - University teaching and research.

5/91 - 6/94 Rensselaer Polytechnic Institute, Troy, New York

Director, Center for Multiphase Research - University teaching, research and administration.

7/94 - 3/98 Rensselaer Polytechnic Institute, Troy, New York

Dean of Engineering - Academic administration and research.

## **Consulting**

Argonne National Laboratory

Long Island Lighting Company

Battelle Northwest Laboratories	Nuclear Associates International
Brookhaven National Laboratory	Oak Ridge National Laboratory
Babcock & Wilcox Company	PJM Interconnection( <b>Board Member</b> )
Combustion Engineering (ABB)	Sandia Laboratories
Corning, Inc	Savannah River Laboratory
Creare, Inc.	Singer Link-Miles
EG&G Idaho, Inc. (INEL)	Stauffer Chemical Company
Electric Power Research Institute	Stone & Webster
Exxon Nuclear Company, Inc.	U.S. Department of Energy
General Electric	U.S. Nuclear Regulatory Commission
General Public Utilities	Westinghouse (NED)
International Atomic Energy Agency	Yankee Atomic Electric Company
Air Products	
	Jason Associates
NYS-DEC ; NYS- OAG	
	NYC (Couch White , LLP)
Norhtrop Grumman	

### **Professional Memberships and Technical Review Groups**

American Nuclear Society (ANS)

President, Northeastern New York Section (78-79)

Member, Board of Directors (79-82)

Member, ANS Executive Committee (80-82)

Member, Executive Committee - Power Division (79-82)

Chairman, Technical Group for Thermal-Hydraulics (79-80)

Member, Executive Committee - Thermal-Hydraulics (80-81)

Member, E.E.&A. Accreditation Committee (84-87)

Member, NHTC Coordinating Committee (86-89)

Member, ANS Nominating Committee (86)

American Society of Mechanical Engineers (ASME)

Nucleonics Heat Transfer Committee (ASME K-13)

Chairman (78-81)

American Society of Engineering Education (ASEE)

Chairman, Program Committee (86-87)

Chairman, Nuclear Engineering Division (87-88)

American Institute of Chemical Engineers (AIChE)

Chairman, Energy Transport Field Research Committee (87-91)

Association of Engineering Colleges in New York State (AECNYS)

Secretary/Treasurer (96)

ECPD Council

ASME Representative, (76-79)

Engineering Manpower Commission (EMC)

Commissioner (81-84)

Council on Competitiveness

Member (94-98)

Nuclear Engineering Department Heads Organization (NEDHO)

Chairman (82-83)

Liaison with USNRC and USDOE (82-87)

International Center for Multiphase Flow - Japan

Corresponding Member (USA)

The New York Academy of Sciences (NYAS)

Member (90-09)

Society of the Sigma Xi

Member (70-Present)

#### Editorial Boards

***Journal of Nuclear Engineering & Design ( Formerly Editor -NE&D , 83-94)***

***International Journal of Heat & Mass Transfer***

***International Communications in Heat & Mass Transfer***

***Journal of Multiphase Science & Technology***

Nuclear Safety Review Board (RPI)

Chairman (76-87)

EG&G Scientific Advisory Committee

Member (76-83)

Review Group Membership

USNRC Advanced Code Review Group (76-84)

USNRC Two-Phase Instrumentation Review Group (76-84)

USNRC Containment Code Review Group (77-84)

USNRC Two-Phase Flow Calibration Review Group (78-84)

USNRC LOFT Review Group (77-83)

USNRC EBTF Research Review Group (79-82)

USNRC 2D/3D Review Group (79-84)

USNRC BWR BDHT Review Group (79-84)

EPRI Design Review Committee Member for MAAP Code (88-93)

EPRI Design Review Committee Member for BWR SAR Code (88-90)

LILCO Peer Review Committee Member (88-92)

USDOE Savannah River Laboratory (SRL) Review Group Member (88-92)

USDOE Advanced Neutron Source (ANS) Review Panel (88-92)

ORNL Engineering Technology Division Advisory Committee - Chairman (89-92)

ORNL Advanced Neutron Source (ANS) Reactor Advisory Committee - Chairman (92-93)

ORNL CASL Science Council - Member (2010 - Present)

National Association of Corporate Directors (NACD) - Member (97-Present)

National Academy Activities

Member, National Research Council (NRC) -Space Science Boards Committee on Microgravity Research (1997-2008)

Member, National Research Council (NRC) Study on: "Microgravity Research in Support of Technologies for the Human Exploration and Development of Space and Planetary Bodies" (1998-2000).

Member, National Research Council (NRC) Study on: "The Safety and Security of Commercial Spent Fuel Storage" ( 2004 - 2006).

Member, National Research Council (NRC) Decadal Study on: "Biological and Physical Sciences in Space" ( 2009 - 2010).

## Honors

- Elected Fellow of ANS (1980)
- Elected Life Fellow of ASME (1980)
- Elected ***National Academy of Engineering*** (1994)
- Elected ***Russian National Academy of Sciences-Baskortostan*** (1995)
- Graduated (with Honors) - USMMA (1961)
- Nominated: G.E.s Steinmetz Award (1975)
- Whos Who in Engineering
- Whos Who in the East
- International Whos Who in Energy & Nuclear Sciences
- Whos Who in Technology Today
- American Men & Women of Science (17<sup>th</sup> Edition)
- The International Whos Who of Intellectuals (Vol. VI)
- *Fulbright-Hays* Fellowship (1983-1984)
- Elected Senior Fellow-Magdalen College of Oxford University (1983-1984)
- Keynote Lecture, 5<sup>th</sup> Indian Heat & Mass Transfer Conference, Hyderabad, India (1980)
- Editor, ***Journal of Nuclear Engineering and Design***, (1983-1994)
- Appointed IAEA Expert to Assist Argentina in Nuclear Power Research (1985-Present)
- Keynote Lecturer, International Workshop on Two-Phase Flow Fundamentals, NBS, Gaithersburg, MD (1985)
- People-to-People Delegation Leader to the PRC on Nuclear Reactor Safety (11/4-25/85)
- Keynote Lecture, 4<sup>th</sup> International Symposium on Multi-Phase Transport & Particulate Phenomena - Miami, Florida (1986)
- Keynote Lecturer, International Centre for Heat and Mass Transfer, Dubrovnik, Yugoslavia (1987)
- Chairman, DOE/EPRI Second International Workshop on Two-Phase Flow Fundamentals (3/87)
- Visiting Professor, University of Pisa, Pisa, Italy (1987)
- Visiting Professor , Universite Claude Bernarde, Lyon, France (1987)
- Appointed External Dissertation Reviewer - Univeriti Malaya (1987)
- Visiting Professor of Engineering , Centro Atomico, Bariloche, Argentina (1988)
- Keynote Lecture, Japan Society of Multiphase Flow - Tokyo, Japan (1988)

- Appointed Honorary Senior Fellow - Magdalen College of Oxford University (1989-Present)
- Elected Chairman of RPI Faculty Council (1989-1991)
- Japan Society for the Promotion of Science (JSPS) Fellowship (1990)
- Keynote Lecture, American Society of Mechanical Engineers, Dallas, TX (1990)
- Alpha Nu Sigma Honor Society (1992)
- Plenary Lecturer, International Symposium on Instabilities in Multiphase Flows - Rouen, France (5/92)
- Member, Editorial Advisory Board - *International Journal of Heat and Mass Transfer*
- Member, Editorial Advisory Board - *International Communications in Heat and Mass Transfer*
- U.S. Representative, International Information Center for Multiphase Flow (ICeM)
- Mark S. Mills Award of the ANS [Advisee: Susana Kalkach-Navarro] (1993)
- Elected Member of RPI Engineering Research Council (1993-1994)
- General Chairman, International Topical Meeting on Nuclear Reactor Thermal-Hydraulics (NURETH-7), Sept. 10-15, 1995
- Member, Advisory Editorial Board - *Heat Transfer Research*
- Keynote Lecture, MFTP-2000, Antalya, Turkey (2000)
- Member, Presidium, ICMS-2000, Ufa, Russia (2000)
- Listed as an Expert Knowledge Provider , Intota web site, *www.intota.com* (2001)
- Keynote Lecture , HEAT-2002 , Kielce, Poland (2002)
- Member - Engineering Advisory Board , U.S. Merchant Marine Academy (2003-2005)
- Elected to Palmer C. Ricketts Society of Patrons - RPI (2004-present )
- Co-Chair , Japan/US Seminar on Two-Phase Flow Dynamics , Nagahama, Japan (2004 )
- Plenary Lecture , PISA' 04 , Pisa , Italy (2004)
- Keynote Lecture , Yadigaroglu Retirement Seminar , ETH-Zurich , Zurich, Switzerland (2004)
- Keynote Lecture, ISMF' 05, Xi'an , China (2005)
- Keynote Lecture, NURETH-11 , Avignon, France (2005)
- *Alexander von Humbolt* Senior Scientist Fellowship-FZK (2005-2006)
- Keynote Lecture , NURETH-12 , Pittsburgh , PA. (2007)

## Awards

- Meritorious Service Award of the ANS (1983)
- **Glenn Murphy Award** of the ASEE (1985)
- Technical Achievement Award of the ANS (1985)
- United States Merchant Marine Academy Alumni Association, Outstanding Professional Achievement Award (1986)
- **E.O. Lawrence Memorial Award** of the USDOE (1988)
- **Arthur Holly Compton Award** of the ANS (1989)
- **Donald Q. Kern Award** of the AIChE (1989)
- **Glenn T. Seaborg Medal** of the ANS (1992)
- ASME/ANS NHTC Best Paper Award (1993)
- **William H. Wiley Distinguished Faculty Award**-RPI (2004)

## Books and Monographs

"Out-of-Pile Subchannel Measurements in a Nine-Rod Bundle for Water at 1000



PSIA," Progress in Heat and Mass Transfer, Vol. 6, 1972 (with B. Shiralkar)

"Non-Equilibrium Two-Phase Flows" (Associate Editor), ASME Symposium Volume, 1975.

The Thermal-Hydraulics of a Boiling Water Nuclear Reactor , ANS Monograph, 1977 (with F. Moody).

"Light Water Reactors: Thermal-Hydraulic Aspects of Nuclear Reactor Safety" (Associate Editor), ASME Symposium Volume, 1977.

"Topics in Two-Phase Heat Transfer & Flow" (Associate Editor), ASME Symposium Volume, 1977.

"Power Reactor Concepts and Systems Overview," Chapter 2, Nuclear Reactor Safety Heat Transfer, Hemisphere Press, 1980.

"Light Water Nuclear Reactors," Chapter 4, Nuclear Reactor Safety Heat Transfer, Hemisphere Press, 1980.

"Fundamental Concepts of System Safety Modeling," Chapter 8, Nuclear Reactor Safety Heat Transfer, Hemisphere Press, 1980.

"Basic Mechanisms in Two-Phase Flow and Heat Transfer," (Associate Editor), ASME Symposium Volume, 1980.

"Section 507: Vaporization/Boiling Heat Transfer," Heat Transfer and Fluid Flow Data Book, General Electric Company, 1981.

"Transient Analysis of Two-Phase Systems," Two-Phase Flow Dynamics , Hemisphere Press, 1981.

"Current Boiling Water Nuclear Reactor LOCA Issues," Two-Phase Flow Dynamics , Hemisphere Press, 1981.

"Advances in Two-Phase Flow Instrumentation," Advances in Nuclear Science and Technology, Vol. 13, 1981 (with S. Banerjee).

"On the Junction Problem in Two-Phase Flow," Selected Topics in Two-Phase Flow, Tapir, 1984.

"An Analysis of Density-Wave Oscillations in Ventilated BWR Fuel Rod Bundles," Multi-Phase Flow and Heat Transfer III, Part A: Fundamentals, eds. Veziroglu & Bergles, Elsevier, 1984 (with R. Taleyarkhan and M. Podowski).

"Three Dimensional Conical Probe Measurements in Turbulent Air/Water Two-Phase Pipe Flow," TSI Quarterly (Flow Lines), 1987 (with S.K. Wang, S.J. Lee and O.C. Jones, Jr.)

"Phase Distribution in a Triangular Duct," Multiphase Science and Technology ,

Vol. 3, Hemisphere Press, 1987.

"Dividing Flow in a Tee Junction," Multiphase Science and Technology , Vol. 3, Hemisphere Press, 1987.

"On the Analysis of Instabilities in Two-Phase Flows," Multiphase Science and Technology, Vol. 4, pp. 183-370, Hemisphere Press, 1989 (with M. Podowski).

"The Three Dimensional Time and Volume-Averaged Conservation Equations of Two-Phase Flows," Advances in Nuclear Science & Technology, Vol. 20, pp. 1-69, 1989 (with D.A. Drew).

"The Prediction of Phase Separation in a Branching Conduit Using a Three-Dimensional Two-Fluid Model," Editor, T.N. Veziroglu, Multiphase Transport and Particulate Phenomena, Vol. 1, Hemisphere Corp., 1990 (with S. Kalkach-Navarro, S.J. Lee and D.A. Drew).

"Relation of Microstructure to Constitutive Relations," Editors, Daniel D. Joseph and David G. Schaeffer, Two Phase Flows and Waves, Vol. 26, Springer-Verlag, 1990 (with D.A. Drew and G.S. Arnold).

"The Dispersion and Attenuation of Small Amplitude Standing Waves and the Propagation of Acoustic Pressure Pulses in Bubbly Air/Water Two-Phase Flows," Multiphase Science & Technology, Vol. 6, Hemisphere Press, 1992 (with A.E. Ruggles).

"Boiling Heat Transfer - Modern Developments and Advances," Elsevier, 1992 (Editor).

"Analytical Modeling of Multiphase Flows," Editor, M.D. Roco, Particulate Two-Phase Flow, 1993 (with D.A. Drew).

The Thermal-Hydraulics of a Boiling Water Nuclear Reactor , Second Edition, ANS Monograph, 1993 (with F.J. Moody).

"Two-Phase Flow," The Engineering Handbook, CRC Press, 1994.

Multiphase Science and Technology , Volume 8, "Two-Phase Flow Fundamentals," Begell House, Inc., New York, 1996 (Co-Editor with G.F. Hewitt, et al).

"A CFD Analysis of Multidimensional Two-Phase Flow and Heat Transfer Phenomena," Process, Enhanced and Multiphase Heat Transfer (A.E. Bergles - Festschrift), Begell House, Inc., New York, 1996.

"Two-Phase Instabilities," International Encyclopedia of Heat & Mass Transfer, CRC Press, 1997.

"The Air Carryunder Induced by Plunging Liquid Jets," International Encyclopedia of Heat & Mass Transfer, CRC Press, 1997 (with F. Bonetto).

"Three-Phase Flow Measurements using A Hot-Film Anemometer," Applied Optical Measurements, Editor, M. Lehner et al, Springer, 1999.

" Microgravity Research in Support of Technologies for the Human Exploration and Development of Space and Planetary Bodies" , National Reserach Council - Space Studies Board Topical Report , 2000

"Sonoluminescence and the Search for Sonofusion", Advances in Heat Transfer, Academic Press, Vol. 35, pp: 1-168, 2005.

"Recent Advances and Results in Acoustic Inertial Confinement Bubble Nuclear Fusion", Low Energy Nuclear Reactions and New Energy Technologies Source Book V.2, Oxford University Press, Chapter-8, pp: 139-157, 2009 (with R.P. Taleyarkhan, C.D. West,R.I. Nigmatulin, R.C. Block, J.S. Cho, Y. Yu).

"Acoustic Inertial Confinement (Bubble) Nuclear Fusion", Energy Encylopedia, John Wiley & Sons, 2010 ( with R.P. Taleyarkhan, R. I. Nigmatulin ).

### **Refereed Publications (Journals)**

"Mass Flux and Enthalpy Distribution in a Rod Bundle for Single- and Two-Phase Conditions," *Journal of Heat Transfer*, May 1971 (with B. Shiralkar).

"An Exact Solution for Flow Transients in Two-Phase Systems by the Method of Characteristics," *Journal of Heat Transfer*, November 1973 (with J.M. Gonzalez-Santalo).

"The Variation of the Vapor Volumetric Fraction During Flow and Power Transients," *Nuclear Engineering and Design*, 25, 1973 (with B. Shiralkar).

"The Effect of Obstacles on a Liquid Film," *Journal of Heat Transfer* , November 1973 (with B. Shiralkar).

"On the Various Forms of the Conservation Equations in Two-Phase Flow," *International Journal of Multiphase Flow*, No. 2, 1976 (with G. Yadigaroglu).

-An Exact Analytical Solution of Pool Swell Dynamics During Depressurization by the Method Characteristics," *Nuclear Engineering and Design*, 45, 101-116, 1978 (with H.W. Veal).

"A Turbine-Meter Evaluation Model for Two-Phase Transients," *Journal of Heat Transfer*, 102, 2/9-13, 1980 (with P.S. Kamath).

"The Analysis of Virtual Mass Effects in Two-Phase Flow," *Int. J. of Multiphase Flow*, 5, 233-242, 1979 (with D.A. Drew and L. Cheng).

"Application of General Constitutive Principles to the Derivation of Multidimensional Two-Phase Flow Equations," *Int. J. Multiphase Flow*, Vol. 4, 243-264, 1979 (with D.A. Drew).

- "An Experimental Technique for Determination of Steam Fraction in Flowing Steam/Air Mixtures," ***Nuclear Technology***, 48, 1980 (with N. Saba and J.C. Corelli).
- "The Analysis of Boiling Water Reactor Long-Term Cooling," ***Nuclear Technology***, 49, 1980 (with P.S. Kamath).
- "The Analysis of CCFL using Drift-Flux Models," ***Journal of Nuclear Engineering and Design***, 61, 245-255, 1980 (with K. Ohkawa).
- "The Effect of Gravity and Friction on the Stability of Boiling Flow in a Channel," AIChE Symposium Series, #199, Vol. 76, 1980- ***Chem. Eng. Commun.***, Vol. 11, 59-79, 1981 (with J-L. Achard and D.A. Drew).
- "Transient Analysis of DDT Rakes," ***Nuclear Engineering and Design***, 65, 342-367, 1981 (with P.S. Kamath).
- "Development of a Radio-Frequency Excited Local Impedance Probe," ***Nucl. Eng. and Design***, 67, 125-136, 1981 (with M. Vince and G. Krycuk).
- "The Effect of Virtual Mass on the Numerical Stability of Accelerating Two-Phase Flows," ***Int. J. Multiphase Flow***, 6, 1981, (with L. Cheng, D.A. Drew and J.E. Flaherty).
- "The Measurement of Phase Separation in Wyes and Tees," ***Nucl. Eng. and Design***, 64, No. 1, 1981 (with T.J. Honan).
- "Phase Distribution Mechanisms in Turbulent Two-Phase Flow in Channels of Arbitrary Cross Section," ASME ***J. of Fluids Eng.***, 103, 583-589, 1981 (with D.A. Drew).
- "On the Development of an Objective Flow Regime Indicator," ***Int. J. Multiphase Flow***, 8, No. 2, 93-124, 1982 (with M.A. Vince).
- "Phase Distribution Mechanisms in Turbulent Low Quality Two-Phase Flow in a Circular Pipe," ***J. of Fluid Mechanics***, 117, 91-106, 1982 (with D.A. Drew).
- "Optical Probe for High Temperature Local Void Fraction Determination," ***J. of Applied Optics***, 21, 886, 1982 (with M.A. Vince, H.E. Breed and G. Krycuk).
- "Measurement of Flow in Large Pipes by the Pulsed Neutron Activation Method," ***Nucl. Sci. Eng.***, 82, 19-33, 1982 (with M.L. Perez-Griffo and R.C. Block).
- "An Experimental Investigation of BWR Parallel Channel Effects," ***Nucl. Eng. and Design***, 73, 425-440, 1983 (with W.M. Conlon).
- "The Prediction of Pressure Drop and CCFL Breakdown in Countercurrent Two-Phase Flow," ***J. of Heat Transfer***, 105, 1983 (with A. Ostrogorsky and R.R. Gay).
- "An Investigation of BWR/4 Parallel Channel Effects During a Hypothetical LOCA

for Both Intact and Broken Jet Pumps," ***Nuclear Technology***, Vol. 65, No. 2, 1984 (with M. Fakory).

"The Analysis of Phase Separation Phenomena in Branching Conduits," ***Int. J. of Multiphase Flow***, Vol. 10, 1984 (with N. Saba)

"Measurement of Virtual Mass and Drag Coefficients of a Disk Oscillating Sinusoidally in a Two-Phase Mixture," ***Int. J. of Multiphase Flow***, 10, No. 3, 1984 (with P.S. Kamath and D.R. Harris).

"NUFREQ-NP: A Computer Code for the Stability Analysis of Boiling Water Reactors," ***Nuc. Sci & Eng.***, 88, 1984 (with S.J. Peng, M.Z. Podowski and M. Becker).

"The Development of a Gamma-Ray Scattering Densitometer for the Non-Intrusive Measurement of Local Void Fraction," ***Nuclear Technology***, 67, 1984 (with K. Ohkawa).

"An Instability Analysis of Ventilated Channels," ***J. Heat Transfer***, 107, 175-181, 1985 (with R. Taleyarkhan and M. Podowski).

"The Analysis of Nonlinear Density-Wave Oscillations in Boiling Channels," ***J. of Fluid Mechanics***, 155, 213-232, 1985 (with J.L. Achard and D.A. Drew).

"An Analytical Model for the Analysis of BWR/4 Long-Term Cooling with Either Intact or Broken Jet Pump Seals," ***J. of Nuclear Engineering and Design***, 85, 1985 (with M.R. Fakory).

"An Analysis of Wave Propagation in Bubbly Two-Component Two-Phase Flows," ***J. of Heat Transfer***, 107, 1985, (with L.Y. Cheng and D.A. Drew).

"Measurement of Flow in a Horizontal Pipe using the Pulsed Photon Activation Technique," ***Nuc. Sci. Eng.***, 91, No. 3, 1985 (with T.F. Lin, R.C. Bloc, O.C. Jones, Jr. and M. Murase).

"Film Thickness Measurements and Modeling in Horizontal Annular Flows," ***Physicochemical Hydrodynamics***, Vol. 6, No.1/ 2, pp. 197-206, 1985 (with T.F. Lin, O.C. Jones, Jr., R.C. Block and M. Murase).

"The Development of a Closed Form Analytical Model for the Stability Analysis of Density-Wave Oscillations in Boiling Water Nuclear Reactors," ***Nucl. Eng. and Design***, 92, No. 2, 1986 (with G.C. Park, M. Becker, M. Podowski and S.J. Peng).

"A Stability Analysis of Ventilated Boiling Channels," ***J. Nucl. Eng. and Design***, 93, No. 1, 1986 (with M. Podowski and R.P. Taleyarkhan).

"BWR Linear Stability Analysis," ***J. Nucl. Eng. and Design***, 93, No. 1, 1986 (with S.J. Peng and M. Podowski).

"Advances in the Analytical Modeling of Linear and Nonlinear Density-Wave

Instability Modes," *Journal of Nuclear Engineering and Design*, 95, pp. 5-34, 1986.

"Current Understanding of Phase Separation Mechanisms in Branching Conduits," *Journal of Nuclear Engineering and Design*, 95, 1986.

"Horizontal Annular Flow Measurements Using Pulsed Photon Activation and Thickness Distribution Modeling," *Journal of Nuclear Engineering and Design*, 95, 1986 (with T.F. Lin, R.C. Block, O.C. Jones, Jr. and M. Murase).

"The Measurement of Phase Distribution in a Triangular Conduit," *Int. J. of Multiphase Flow*, 12, No. 3, 405-425, 1986 (with S. Sim).

"The Virtual Mass and Lift Force on a Sphere in Rotating and Straining Flow," *J. of Multiphase Flow*, Vol. 13, No. 1, pp. 113-121, 1987 (with D.A. Drew).

"3-D Turbulence Structure and Phase Distribution Measurements in Bubbly Two-Phase Flows," *International Journal of Multiphase Flow*, Vol. 13, No. 3, pp. 327-343, 1987 (with S.K. Wang, S.J. Lee and O.C. Jones, Jr.).

"An Experimental Investigation of BWR/4 Long-Term Cooling with either Intact or Broken Jet Pumps," *Journal of Nuclear Engineering and Design*, Vol. 99, pp. 391-402, 1987 (with M. Fakory).

"An Experimental Study of Two-Dimensional Phase Separation Phenomena," *International Journal of Multiphase Flow*, Vol. 13, No. 3, pp. 327-344, 1987 (with K.M. Bukhari).

"The Effect of Fuel Rod Dynamics on BWR Stability Margin," *Journal of Nuclear Engineering and Design*, Vol. 99, pp. 5-14, 1987 (with R. Taleyarkhan and M.Z. Podowski).

"A Linear Model to Study Fluid Dynamic Instabilities in Boiling Channels due to Density Oscillations," *International Journal of Heat & Technology*, Vol. 5, No. 3.4, 1987 (with F. DAuria, N. DeSanctis, P. DiMarco and M. Podowski).

"An Investigation of the Propagation of Pressure Perturbations in Bubbly Air/Water Flows," *Journal of Heat Transfer*, Vol. 110, 494-499, 1988 (with A. Ruggles, D.A. Drew and H. A. Scarton).

"A Study on Single and Two-Phase Pressure Drop in Branching Conduits," *Int. J. of Experimental Thermal and Fluid Science*, Vol. 1, No. 2, 1988 (with S.T. Hwang).

"Phase Separation in Dividing Two-Phase Flows," *Int. J. of Multiphase Flow*, Vol. 14, No. 4, 1988 (with S.T. Hwang and H. Soliman).

"The Prediction of Two-Phase Turbulence and Phase Distribution Phenomena Using a k-Epsilon Model," *Japanese Journal of Multiphase Flow*, Vol. 3, No. 4, 335-368, 1989 (with S.J. Lee and O.C. Jones, Jr.).

"An Experimental Investigation of Phase Distribution in an Eccentric Annulus ,"  
***Int. J. of Multiphase Flow***, Vol. 15, No. 3, 4470457, 1989 (with K. Ohkawa).

"Phase Separation in Impacting Wyes and Tees," ***Int. J. of Multiphase Flow*** ,  
Vol. 15, No. 6, 965-976, 1989 (with S.T. Hwang and H. Soliman).

"An Analysis of Stability and Oscillation Modes in Boiling Multichannel Loops  
Using Parameter Perturbation Methods," ***International Journal of Heat and  
Mass Transfer***, Vol. 32, No. 11, pp. 2055-2064, 1989 (with A. Clause and M.  
Podowski).

"The Relationship Between Standing Waves, Pressure Pulse Propagation and  
Critical Flow Rate in Two-Phase Mixtures," ***Journal of Heat Transfer*** , Vol. 111,  
467-473, 1989 (with A.E. Ruggles and D.A. Drew).

"Derivation of Constitutive Equations for Interfacial Force and Reynolds Stress for  
a Suspension of Spheres Using Ensemble Averaging," ***Journal of Chemical  
Engineering Communications***, Vol. 86, pp. 43-54, December 1989 (with G.  
Arnold and D.A. Drew).

"A Lumped Parameter Model for Linear and Nonlinear Analysis of Excursive and  
Density-Wave Instabilities in Boiling Channels," ***Energia Nucleare*** , Vol. 6, No. 3,  
pp. 53-59, September-December, 1989 (with P. DiMarco, A. Clause and D.A.  
Drew).

"A Nodal Analysis of Instabilities in Boiling Channels," ***Heat & Technology*** , Vol.  
8, No. 1-2, 1990 (with P. DiMarco, A. Clause and D.A. Drew).

"Statistical Analysis of Turbulent Two-Phase Pipe Flow," ***Journal of Fluids  
Engineering***, Vol. 113, pp. 89-95, 1990 (with S.K. Wang, S.J. Lee and O.C.  
Jones, Jr.)

"The Prediction of Two-Phase Turbulence and Phase Distribution Phenomena  
Using a Reynolds Stress Model," ***Journal of Fluids Engineering***, Vol. 112, pp.  
107-113, 1990 (with M. Lopez de Bertodano, S.J. Lee and D.A. Drew).

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"An Analysis of Phase Separation in Branching Conduits," Proceedings of RPI Summer Course of Modern Developments in Boiling Heat Transfer and Two-Phase Flow, 1988.

"The Development of APRIL.MOD2 - A Computer Code for Core Meltdown Accident Analysis of Boiling Water Nuclear Reactors," NUREG/CR-5157, July, 1988 (with S. Kim, et al).

"An Analysis of Wave Propagation Phenomena in Two-Phase Flow," Proceedings of RPI Summer Course of Modern Developments in Boiling Heat Transfer and Two-Phase Flow, 1989.

"An Analysis of Phase Distribution Phenomena in Two-Phase Flow," Proceedings of RPI Summer Course of Modern Developments in Boiling Heat Transfer and Two-Phase Flow, 1989.

"An Analysis of Phase Separation in Branching Conduits," Proceedings of RPI Summer Course of Modern Developments in Boiling Heat Transfer and Two-Phase Flow, 1989.

"Degraded BWR Core Modeling - Physical Simulations of Selected Components," ESEERCO EP84-4 Final Report, September 1989 (with M.Z. Podowski).

"The Analysis of Void Wave Phenomena," Proceedings of the Eighth Symposium on Energy Engineering Sciences, pp. 27-34, ANL Report CONF-9005183, 1990 (with J-W. Park and D.A. Drew).

"Degraded BWR Core Modeling - APRIL.MOD3 Severe Accident Code," ESEERCO EP84-4 Final Report, July 1990 (with M.Z. Podowski).

"Multiphase Thermal Science," Proceedings of the NSF Workshop on Thermal Sciences, Chicago, April 19-21, 1991.

"A Four Field Model for Two-Phase Flow," 12<sup>th</sup> Symposium on Energy Engineering Sciences, 4/27-29/94, Argonne National Laboratory (with D.A. Drew).

"Synchronic Nonlinear Forcing of a Sonoluminescent Microbubble using Fast Ultrasonic Pulses," Proceedings of the APS, March 1996 (with F.J. Bonetto and G.A. Delgadino).

"A CFD Analysis of Multidimensional Two-Phase Flow and Heat Transfer Using a Four Field Two-Fluid Model," Proceedings of the Thirteenth U.S. National Congress on Applied Mechanics, U of Florida, June 21-26, 1998.

"A CFD Analysis of Multidimensional Two-Phase Flow & Heat Transfer with a Four Field Two-Fluid Model," Proceedings of IMUST Meeting, Santa Barbara, CA, March 18-20, 1999.

"A Center-Averaged Two-Fluid Model for Wall-Bounded Flows," ONR Free Surface and Bubbly Flows Workshop, La Jolla, CA, Feb. 24-26, 1999 (with A.E. Larreteguy and D.A. Drew).

"Multidimensional Two-Fluid Modeling of Two-Phase Flow and Heat Transfer In a Boiling Channel with Applications to CHF Modeling in Forced-Convection Sucedoled Boiling," National Science Agency of Tiawan Report, August 1999 (with C. Pan and D. A. Drew)

"An Analysis of Two-Phase Flow and Heat Transfer using a Multidimensional, Multi-Field, Two-Fluid Computational Fluid Dynamics (CFD) Model", Proceedings of the Japan/US Seminar on Two-Phase Flow Dynamics, Santa Barbara, California, June 5-8, 2000 (with D.A. Drew).

"An Analysis of Rectified Diffusion in a Sonoluminescing Gas Bubble", Proceedings of the Japan/US Seminar on Two-Phase Flow Dynamics, Santa Barbara, California, June 5-8, 2000 (with S. Bae and R. Nigmatulin).

"On the Multidimensional Analysis of Two-Phase Flows" , Proceedings of the USDOE Workshop on Scientific Issues in Multiphase Flow , U. Illinois-CU ,May 7-9 , 2002 ( with D. Drew).

"Sonoluminescence and the Search for Sonoluminescence" , ANS Panel on Advances in Fusion Technology , ANS Annual Meeting , Hollywood , Florida , June 9-13 , 2002

"Response - Tabletop Fusion Revisited ( by: A. Galonsky )" , *Science* on-line , 2002 ( with R. Taleyarkhan , R. Block and C. West ).

"Response - Questions Regarding Nuclear Emissions in Cavitation Experiments (by: M. Saltmarsh and D. Shapira )" , *Science* on-line , 2002 ( with R. Taleyarkhan , R. Block and C. West ).

"Energetics of Nano-to-Macro Scale Triggered Tensioned Metastable Fluids", ORNL/TM-2022/233 , 2002 (with R. Taleyarkhan , C. West , J. Cho and I. Akhatov ).

"The Modeling of Bubbly Flows Around Ship Hulls" , Maui High Performance Computing Center, Application Brief , 2002 ( with F. Moraga and D. A. Drew ).

"Full-Scale Simulations of the Research Ship Roger Revelle", Maui High Performance Computing Center, Application Brief , 2003 ( with F. Moraga and D. A. Drew ).

"The Development of Interfacial Drag and Non-Drag Laws for Stratified Flow using PHASTA-2I" , Proceedings of the American Physical Society, East Rutherford , NJ ,Nov.23-25 , 2003

"Computational Multiphase Fluid Dynamics (CMFD) Analysis of a Single ESBWR Riser Channel," ISL Final Topical Report, 2004 (with S. Antal, M. Popowski).

"Research in Support of the Use of Rankine Cycle Energy Conversion Systems for Space Power and Propulsion," NASA/CR-2004-213142, 2004 (with V. Dhir)

"Safety and Security of Commercial Spent Nuclear Fuel Storage," Classified National Research Council (NRC) Topical Report, 2004.

"Nuclear Engineering External Review Committee Report," Purdue University Report, 2004.

"The CMFD Analysis of Three-Field Chemical Reactors," CREL Topical Report, 2004 (with S. Antal).

"The Sonofusion Research Project at KIT and RPI" , Proceedings of the 62nd Meeting of the American Physical Society - Division of Fluid Dynamics, Minneapolis, Minnesota, November 22-24, 2009 (with Markus Stokmaier, Bernard Malouin, Andreas Class , Thomas Schulenberg).

### **Special Courses Taught**

- RPI Summer Program on Nuclear Reactor Design & Basic Nuclear Technology (RPI sponsored), Troy, NY 1997-1983
- Short course in Introduction to Nuclear Power, Continuing Education Center, (CEC sponsored) Sheraton Motor Inn, East Brunswick, NJ, 1978
- Two-Phase Flow and Heat Transfer (B&W sponsored), Alliance, OH, 1978
- Two-Phase Flow and Heat Transfer (EG&G sponsored), Idaho Falls, ID, 1979-1983
- Two-Phase Flow Instrumentation course (FDI sponsored), Dartmouth University, 1978

- Multiphase Flow Instrumentation course (CEA sponsored), Grenoble, France, 1979
- Workshop on Transient Analysis of Reactors (FRG sponsored), Munich, Germany, 1979
- Reactor Thermal-Hydraulics, AIChE short course, 1976 -1983
- Stanford summer course on Two-Phase Flow Instrumentation, 1980
- Course on Two-Phase Flow and Boiling, Yankee Atomic Electric Company, 1980
- Summer school on Reactor Thermal-Hydraulics (ICHMT sponsored), Dubrovnik, Yugoslavia, 1980
- Stanford summer course on Two-Phase Flow & Heat Transfer (Stanford sponsored), Stanford University, 1982
- Simposio Internacional Sobre Flujos Bifasicos en Tuberias (Mexican sponsored), Cuernavaca, Mexico, 1983
- Lecture Series No. 8, Construction Aspects of Two-Phase Flow Equipment (Norwegian sponsored), Trondheim, Norway, 1984
- Workshop on Industrial Applications of Multiphase Flow (UCS sponsored), Santa Barbara, CA 1985
- Workshop on Two-Phase Heat and Mass Transfer in Single and Multicomponent Systems (RPI sponsored), Troy, NY 1986
- Modern Developments in Boiling Heat Transfer and Two-Phase Flow (CMR sponsored), Troy, NY 1988-present
- An Introduction to Applied Nonlinear Dynamics - Bifurcations, Fractals and Chaos in Heat Transfer and Fluid Flow (ETH sponsored), Zurich, Switzerland, 1994-1996
- Short Course on Multiphase Flow and Heat Transfer (ETH sponsored), Zurich, Switzerland, 1994-1996
- 2001 Frederic Joliot/Otto Hahn Summer School , Karlsruhe , Germany , August 20-29 , 2001
- Short Course on "Transient Multiphase Flow and Heat Transfer at Microgravity" , NASA , Glenn Resrarch Center , Cleveland , Oh. Sept. 17-19 , 2002 ( with M.Z. Podowski)

## **Research Funding**

### USNRC

Two-Phase Flow Phenomena in Nuclear Reactor Technology

\$1,006,240 6/1/76-5/31/80.

Technical Assistance Program for the Thermal-Hydraulic Stability Analysis  
Relating to Light Water Nuclear Reactors  
\$676,425 3/15/76-94/83.

Multidimensional Effects in LWR Thermal-Hydraulics  
\$176,000 6/1/80-1/31/81.

The Development of Thermal-Hydraulic Stability Methods for BWR's  
\$100,000 9/5/81-9/4/83.

## ONR

An Experimental Study of Plunging Liquid Jet Induced Air Carryunder and  
Dispersion  
\$122,883 11/1/90-10/30/91.

A Study of Spreading Two-Phase Jets  
\$120,000 1/1/94-12/31/95.

A Study of Spreading Two-Phase Jets  
\$138,892 3/1/95-12/31/95.

Bubbly Flow Dynamics and Numerical Implementation in Complex Flows  
\$707,701 2/1/96-6/30/2000.

The Modeling of Two-Phase Flow Around Ship Hulls  
\$900,841 July 1, 2001 - June 30, 2006

The Modeling of Two-Phase Flow Around Ship Hulls  
\$1,128,000. July 1, 2006 - June 30, 2010.

## EG&G

An Investigation of Turbine-Meter Drag Disc Devices in Transient Two-  
Phase Flow  
\$11,000 10/1/76-9/30/77.

Analysis of BWR Inlet Flow  
\$20,000 10/1/77-9/30/78.

An Investigation of Turbine-Meter Drag Disc Devices in Transient Two-  
Phase Flow  
\$121,764 10/15/76-9/30/79.

Analysis of BWR Inlet Flow  
\$78,549 2/1/80-1/31/81.

The Analysis of PNA Techniques  
\$29,323 2/1/80-2/28/81.

The Development of a Global Transient Model for DTT Rakes  
\$55,764 10/1/78-9/30/79.

The Analysis of BWR Inlet Flow Blockage using MAYU-4B  
\$81,258 1/1/80-12/31/80.

## NSF

Three-Dimensional Turbulence Structure Measurement in Two-Phase Flow  
\$218,000 3/1/81-11/30/83.

Three-Dimensional Turbulence Structure Measurements in Two-Phase Flow  
\$78,800 5/1/82-4/30/83.

Three-Dimensional Turbulence Structure in Two-Phase Flow Measurements  
\$77,700 5/1/83-4/20/84.

Phase Separation Mechanisms in Branching Conduits  
\$175,000 12/1/84-1/31/87.

Phase Distribution Phenomena in Complex Geometry Conduits  
\$85,655 3/1/88-2/28-89.

A Study of Phase Separation in Branching Conduits  
\$95,000 2/1/89-1/31/90.

Phase Distribution Phenomena in Multiphase Systems  
\$88,446 9/1/89-8/31/90.

The Modeling of Two-Phase Turbulence  
\$252,351 11/1/01 -10/31/04

## ORNL

The Development of Mechanistic Models for the MARCH-based Analysis of BWR Cores  
\$30,950 9/1/81-8/31/82.

The Development of Mechanistic Models for the MARCH-based Analysis of BWR Cores  
\$117,990 9/1/81-8/31/83.

The Development of Mechanistic BWR Hydraulics and Structural Component Failure Models for the MARCH Code  
\$46,000 9/1/82-8/31/83.

Development of Improved Models for BWR Thermal-Hydraulics and Core Degradation Phenomena  
\$170,748 9/1/83-8/31/85.

Perform Bubble Fusion Analysis and Experiments at RPI and ORNL  
\$95,000 4/3/98-9/30/99.

Analysis of Sonoluminescence/Sonofusion Phenomena to Support ORNL Experiments  
\$164,784 , 7/28/99-7/27/2003.

### Westinghouse

The Analysis of Thermal-Hydraulic Instabilities in Quad-Plus Fuel  
\$97,445 9/1/81-8/31/82.

### EPRI

The Development of Analytical Modules for Nuclear Reactor Simulators  
\$49,085 6/1/81-5/31/82.

Workshop on Two-Phase Flow Fundamentals  
\$15,000 9/1/86-6/30/87.

### ESEERCO

An Analysis of BWR/4 and BWR/5 Pressure Boundary Failure Modes During Core Meltdown and Its Impact on Mark-II Containment  
\$304,667 2/1/84-1/31/86.

The Propagation and Failure Modes in Severely Degraded BWR Cores  
\$210, 568 9/1/85-8/31/86.

Degraded BWR Code Modeling: Radionuclide Transport and Additional Thermal Hydraulics Models for the APRIL Code  
\$399,608 6/1/87-5/31/88.

Modeling and Analysis of Severe Accidents in BWRs Using the APRIL

Computer Code  
\$356,712 1/1/90-12/31/90.

Degraded BWR Code Modeling: The Upgrading and Validation of APRIL as  
an Interactive Computer Code for BWR Severe Accident Analysis  
\$428,862 1/1/92-12/31/92.

## USDOE

An Analysis of the Closure Conditions for Two-Fluid Models of Two-Phase  
Flow  
\$115,000 4/1/86-3/31/87.

Workshop on Two-Phase Flow Fundamentals  
\$98,000 9/1/86-6/30/87.

An Investigation of the Closure Conditions for Two-Fluid Models of Two-  
Phase Flow  
\$120,000 4/1/87-3/31/88.

An Analysis of the Closure Conditions for Two-Fluid Models of Two-Phase  
Flow  
\$120,000 4/1/88-3/31/89.

The Continuum Modeling of Two-Phase Systems  
\$532,088 4/1/89-3/31/93.

A Nonintrusive Measurement System for Multiphase Flows  
\$134,549 6/30/89-6/29/90.

Analysis of Nuclear Reactor Instability Phenomena  
\$83,278 6/1/91-5/31/92.

The Continuum Modeling of Two-Phase Systems  
\$128,000 4/1/92-3/31/93.

Analysis of Nuclear Reactor Instability Phenomena  
\$88,384 4/15/93-4/14/94.

The Development of Multidimensional Two-Fluid Modeling Capabilities  
\$129,551 4/1/94-3/31/97.

Multidimensional Analysis of Bubble Dynamics Associated with Bubble  
Fusion Phenomena  
\$404,203 7/1/99-6/30/2002.

## KAPL

The Development of Improved Models for BWR Thermal-Hydraulics and  
Core Degradation Phenomena



\$50,000 9/1/85-8/31/85.

Turbulent Phenomena in Two-Phase Flows  
\$32,000 4/15/86-4/14/87.

The Development of Improved Models for BWR Thermal-Hydraulics and  
Core Degradation Phenomena  
\$14,997 9/1/86-8/31/87.

A Review of KAPL Methodology in the Area of Multiphase Flow and Heat  
Transfer  
\$30,163 7/8/91-7/7/92.

The Mechanistic Analysis of Critical Heat Flux Using Two-Fluid Models  
\$73,796 4/1/93-9/30/93.

The Mechanistic Analysis of Critical Heat Flux Using Two-Fluid Models  
\$184,529 10/1/93-9/30/94.

The Mechanistic Analysis of Critical Heat Flux Using Two-Fluid Models  
\$149,080 10/1/94-9/30/95.

The Mechanistic Analysis of Critical Heat Flux Using Two-Fluid Models  
\$80,300 12/1/95-4/30/96.

The Analysis of Annular Two-Phase Flows  
\$227,049 7/1/03-6/30/06

### CAAPS

Enabling Technology for Multiphase Flow Food Processing  
\$48,927 9/1/92-8/31/93.

Enabling Technology for Multiphase Flow Food Processing  
\$51,305 9/1/93-8/31/94.

Enabling Technology for Multiphase Flow Food Processing  
\$54,333 9/1/94-8/31/95.

### NASA

The Analysis of Phase Distribution Phenomena in Microgravity Environments  
\$119,438 5/1/92-4/30/93.

The Analysis of Phase Distribution Phenomena in Microgravity Environments

\$120,000 12/1/93-11/30/95.

The Analysis of the Effect of Gravity on Multiphase Flows  
\$396,544 7/26/04 - 9/30/07

## GE

Two-Phase Flow Analysis  
\$10,152 7/15/92-11/1/92.

Two-Phase Flow Analysis  
\$24,180 12/14/92-3/1/93.

The Development of Multidimensional Modeling Capabilities for Annular Flows in Heated Assemblies  
\$203,756 8/1/96-9/1/98.

## Master's Degrees

### Completed

- Vea, Henry W., "An Exact Analytical Solution of Pool Swell Dynamics During Depressurization by the Method of Characteristics" (1977)
- Kamath, Pradeep, "A Turbine Meter Evaluation Model for Two-Phase Transients" (1977)
- Sim, Suk Ku, "An Analysis of Phase Distribution Mechanisms in Turbulent Two-Phase Pipe Flow" (1977)
- Cheng, Lap-Yan, "Virtual Mass Effects in Two-Phase Flow" (1977)
- Saba, Nematollah, "An Experimental Technique for the Determination of Steam/Air Fraction" (1977)
- Ohkawa, Katsu, "The Analysis of BWR Inlet Flow Blockage" (1978)
- Schell, Susan, "The Development of A Sid-Scatter Gamma Ray Technique for the Measurement of Void Fraction" (1978)
- Lombardo, Nicholas, "The Instrumentation and Data Processing of a Large Freon Loop (1978)
- Honan, Timothy J., "Phase Separation in Wyes and Tees" (1978)
- Shum, Feibiu, "The Development of a 4-Equation Drift-Flux Computer Code (DRIFT-4)" (1978)
- Drozd, Andrew , "NUFREQ-S: A Frequency Domain Drift-Flux Technique for the Evaluation of the Thermal-Hydraulic Stability of Boiling Systems" (1980)
- Ostrogorsky, Alexander , "The Analysis of Countercurrent Two-Phase Flow Pressure Drop and CCFL Breakdown in Diabatic and Adiabatic Conduits" (1980)
- Nissley, Mitchell , "The Analysis of Proposed BWR Inlet Blockage Experiments Using MAYU-4b" (1981)
- Antal, Steven, "An Evaluation of Boiling Water Nuclear Reactor Stability Using Systems Pressure Perturbation (1982)
- Balaram, J., "Stability Margins for Boiling Water Nuclear Reactors: A Multi-Input Multi-Output Analysis" (1982)

- Shatas, Jr., Joseph F., "A Streak Photography Method for Use in Two-Phase Flow" (1982)
- Lee, Sung Jin, "The Development of a Digital Data Processing System for Two-Phase Turbulence Data" (1982)
- Sterner, R.W., "Air/Water Subchannel Measurements of the Equilibrium Quality and Mass Flux Distribution in a Rod Bundle" (1983)
- Petzold, J.F., "Mathematical Modeling of U-Tube Steam Generator Dynamics for Slow Transients and Small Break for Loss-of-Coolant Accidents (1983)
- Koh, Byung R., "The Model of Emergency Core Cooling Systems for Severe Accident Analysis of Boiling Water Reactors (BWRs)" (1984)
- Bryam, Morris, "Modification of Brookhaven National Lab BWR Plant Analyzer to Accommodate BWR-2 Design of Nine Mile Point-1 Nuclear Power Station" (1987)
- Campanella, Rick, "Wave Propagation Phenomena in Bubbly Two-Component Two-Phase Flows" (1988)
- Kalkach-Navarro, Susana, "A Mechanistic Analysis of Phase Separation in Branching Conduits Using Three-Dimensional Two-Fluid Models" (1988)
- Kimpland, Robert, "A Phenomenological Model for the Prediction of Phase Separation in Branching Conduits" (1990)
- Haley, Thomas C., "A Characteristic Analysis of Mathematical Models of Two-Phase Flow in One Space Dimension" (1990)
- Mayo, Stephen, "Void-Fraction and Velocity Measurements in Three-Phase Flow Using a Hot-Film Anemometer" (1994)
- Potterf, Samuel, "Modeling of Heat Transfer Through Stratified Multiphase Flow in a Horizontal Pipe Using Drift-Flux Techniques, with Special Applications to Aseptic Food Processing" (1995)
- Bolotnov, I., "A Non-Linear Spectral Model for Bubble-Induced Turbulent Viscosity in Bubbly Two-Phase Flow" (2003)
- Saglime, Frank, "Experimental Results for the RPI Bubble Fusion Project" (2004)
- Trofimova, Alisa, "The Direct Numerical Simulation of Turbulent Channel Flows" (2007)

#### In Progress

- None

#### **Doctoral**

#### Completed

- Vince, Mark A., "Flow Regime Identification and Void Fraction Measurement Techniques in Two-Phase Flow" (1980)
- Kamath, Pradeep, "The Transient Analysis of DDT Rakes" (1981)
- Saba, Nematollah, "Phase Separation Phenomena in Branching Conduits (1981)
- Perez-Griffo, Maria, "Analysis of the Pulsed Neutron Activation Technique (1981)
- Conlon, William M., "An Experimental Investigation of Boiling Water Nuclear Reactor parallel Channel Effects during a Postulate Loss-of-Coolant Accident (1982)
- Taleyarkhan, Rusi P., "An Analysis of Density-Wave Oscillations in Ventilated Channels (1982)
- Ohkawa, Katsuhiko, "The Development of a Gamma-Ray Scattering Densitometer and its Application to the Measurement of Two-Phase Density Distribution in an Annular Test Section" (1983)
- Cheng, Lap-Yan, "An Analysis of Wave Dispersion, Sonic Velocity and Critical Flow in Two-Phase Mixtures" (1983)

- Park, Goon C., "The Development of NUFREQ-N, an Analytical Model for the Stability of Nuclear Coupled Density-Wave Oscillations in Boiling Water Nuclear Reactors" (1983)
- Fakory, Mohammad, "Parallel Channel Effects and Long-Term Cooling During Emergency Core Cooling in a BWR/4" (1984)
- Peng, Shie-Jeng, "NUFREQ-NP - A Digital Computer Code for the Linear Stability Analysis of Boiling Water Nuclear Reactors" (1984)
- Lin, Thomas Fu Yuan, "An Application of Pulsed Photon Activation Technique in Single- and Two-Phase Flow Measurements (1984)
- Bukhari, Khalid M., "Phase Separation and Distribution Phenomena in a Two-Dimensional Test Section" (1985)
- Wang, Shou-Kong, "Three-Dimensional Turbulence Structure Measurements in Air/Water Two-Phase Flow" (1985)
- Koh, Byung R., "The Modeling of BWR Thermal-Hydraulics for Severe Accident Analysis (1986)
- Sim, Suk K., "Phase Distribution Phenomena in Triangular Conduits (1986)
- Hwang, Sun-Tack, "A Study on Phase Separation in Branching Conduits" (1986)
- Lee, Sung-Jin, "Turbulence Modeling in Bubbly Two-Phase Flows" (1986)
- Ruggles, Arthur E., "The Propagation of Pressure Perturbations in Bubbly Air/Water Flows" (1987)
- Kim, Seok H., "The Modeling and Analysis of BWR Severe Accidents (1987)
- Arnold, Gary S., "Entropy and Objectivity as Constraints Upon Constitutive Equations for Two-Fluid Modeling of Multiphase Flows" (1988)
- SiAhmed, El-Khider, "An Experimental and Theoretical Investigation of Melt Propagation in a Rubble Bed with Applications to Degraded Nuclear Reactor Cores" (1988)
- Kim, Dong-Ha, "An Analysis of Corium/Structure Interaction during Severe Accidents in Boiling Water Nuclear Reactors" (1990)
- Lopez de Bertodano, Martin, "Turbulent Bubbly Two-Phase Flow in a Triangular Duct" (1992)
- Park, Jee-Won, "Void Wave Propagation in Two-Phase Flow" (1992)
- Cho, Chang-Sok, "Modeling and Analysis of Radionuclide Transport during Severe Accidents in Boiling Water Nuclear Reactors" (1992)
- Valenti (Kalkach-Navarro), Susana, "The Mathematical Modeling of Flow Regime Transition in Bubbly Two-Phase Flows" (1992)
- Jia, Hong, "Multidimensional Effects During Corium Spreading and Corium-Concrete Interaction in BWRs" (1992)
- Yoon, Juh-Yeon, "A Streamline Upwinding Finite Element Method for Multiphase Flow and Heat Transfer Analysis" (1993)
- Antal, Stephen P., "Phase Distribution in Bubbly Two-Phase Flows" (1994)
- Alajbegovic, Ales, "Phase Distribution and Turbulence Structure for Solid/Fluid Upflow in a Pipe (1994)
- Chang, Chin-Jang, "The Analysis of Chaotic Instabilities in Boiling Systems" (1994)
- Kim, Shin-Whan, "Computer Simulation of Severe Accidents in Boiling Water Nuclear Reactors" (1994)
- Assad, Amir, "An Experimental Study of Phase Distribution and Turbulence Structure for Solid/Liquid Flow in Horizontal and Vertical Pipes" (1995)
- Garea, Veronica B., "Nodal Analysis of Two-Phase Flow Instabilities" (1998)
- Moraga, Francisco, "Lateral Forces on Rigid Spheres in a Turbulent Uniform Shear Flow" (1998)
- Nigmatulin, Tagir, "An Experimental and Theoretical Study of Interfacial Area Density for different Two-Phase Flow Regimes" (1999)
- Bae, Song H., "A Theoretical Investigation of the Dynamics of Single Bubble

Sonoluminescence" (1999)

- Delgadino, Gerardo, "The Dynamics of Single Bubble Sonoluminescence" (1999)
- Singhal, Maneesh, "The Effect of Dispersed Phase Buoyancy on Phase Distribution" (2004)
- Yin, Juan, "Modeling and Analysis of Multiphase Instabilities" (2004)
- Cancelos, Silvina, "Effect of Acoustically-Induced Pressures on the Permeability of a Bullfrog Urinary Bladder" (2007)
- Galimov, Azat, "An Analysis of Interfacial Waves and Air Ingestion Mechanisms" (2007)
- Bolotnov, Igor, " Cascade Modeling of Single and Two-Phase Turbulence" (2008)
- Ortega-Gomez, Tino, "Stability Analysis for High Performance Light Water Reactor" - U. Karlsruhe, Germany (2008)
- Rodriguez, Joseph M., "Numerical Simulation of Two-Phase Annular Flow" (2009)
- Schlichting, William R., " An Analysis of the Effect of Gravity on Interacting DWO/PDO Instability Modes" (2009)

### **In Progress**

- Markus Stokmaier (FZK)