

## **Dennis K. McLaughlin**

**PRESENT POSITION:** Professor of Aerospace Engineering (1986-present) March, 2009  
The Pennsylvania State University  
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Dr. McLaughlin is Professor of Aerospace Engineering at the Pennsylvania State University, a position he has held since 1986. From 1986 to June, 2004 he served as Head of the Department. He received his graduate degrees including the Ph.D. in Aeronautics and Astronautics, from the Massachusetts Institute of Technology following a BS degree from the University of Manitoba in Canada. Following his studies at MIT, he was a Professor at Oklahoma State University for 11 years and he spent 5 years as Group Manager at Dynamics Technology Inc., in Torrance, CA. He teaches and conducts research in the general areas of experimental aerodynamics and aeroacoustics focusing on measurements that connect flow instabilities and turbulence to the radiated noise. High-speed jet noise experiments in the high subsonic and supersonic flow regimes have provided major data bases for the validation of developing jet noise simulation codes. More recent contributions have been exploring the nonlinear propagation aspects of high speed jet noise. He has recently been developing ducted lift-fans for versions of VTOL vehicles while performing hover and wind tunnel experiments. He has widely published the results of his research and continuously presented the results at national meetings and invited lectures. Professor McLaughlin is a Fellow of the AIAA and has served on several advisory panels including the FAA REDAC Committee. He is a past chair of the Aerospace Department Chairs Association, the AIAA Aeroacoustics Technical Committee, and the AIAA Academic Affairs Committee.

### **EDUCATION:**

Ph.D., in Aeronautics and Astronautics, Massachusetts Institute of Technology, 1970  
E.A.A.; S.M., in Aeronautics and Astronautics, MIT, 1966  
B.Sc., in Mechanical Engineering (with gold medal), University of Manitoba, 1963

### **PROFESSIONAL HISTORY:**

#### **1986-2004**

Professor and Department Head, Aerospace Engineering, Penn State University,

#### **1981-1986**

Senior Research Scientist, Group Manager, Dynamics Technology Incorporated  
Directed research and development in several aeronautical and oceanographic applications.

#### **1978-1979**

Visiting Aerospace Engineer, Aeroacoustics Branch, NASA Langley Research Center  
Conducted experiments and computer simulations of supersonic jet noise.

#### **1970-1981**

Professor, School of Mechanical and Aerospace Engineering, Oklahoma State University (1978-81);  
Associate Professor (1974-78); Assistant Professor (1970-74)  
Teaching and research in aerodynamics and high speed jet noise.

#### **1969-1970**

Research Engineer, MIT Aerophysics Laboratory  
Wind tunnel experiments on the stability and transition of magnetically suspended cone models.

### **CONSULTING EXPERIENCE (Past 15 years):**

## MAJOR RESEARCH PROJECTS (Continued):

2002-03	American AeroStructures
1997-98	Flight Safety Technologies, Inc.
1996	Digicon Geophysical Corp.
1995-96	The Analytic Sciences Corporation

## SIGNIFICANT COMMITTEE ACTIVITIES:

AIAA - Academic Affairs Committee, 2000 - present, Chairman, 2004 – 2007.  
International Journal of Aeroacoustics, Editorial Board, 2002 - present  
ADCA - Aerospace Department Chair's Association, Member, 1986-2004;  
Secretary/Treasurer, 1988-1990, Chairman, 1991-1993  
AIAA - Aeroacoustics Technical Committee, Member, 1978-1980; 1998 – 2005,  
Chairman, 1999 – 2001.  
Program Evaluator: University of Cincinnati, Aerospace Engineering and Mechanics, 2003  
Program Evaluator: University of Oklahoma, Aerospace and Mechanical Engineering, 2002  
National Research Council ASEP National Institute of Aerospace Proposal Review Committee, 2002  
FAA RE & D Security Subcommittee, 1997 - 2001  
FAA RE & D Subcommittee on Challenge 2000 project  
FAA Research, Engineering and Development Advisory Committee, 1995 – 1999  
Southern University Aeronautical Research and Education Program Advisory Board, 1994 - 1997  
Program Evaluator: University of Southern California, Aerospace Engineering, 1995  
Penn State Applied Research Laboratory Advisory Board, 1989-1992  
NSF SBIR Proposal Review Panel, 1987  
AIAA Oklahoma Section, Chairman, 1980-1981

## MAJOR RESEARCH PROJECTS: (Principal Investigator or Co-PI)

"Distributed Conformal Actuation for Simultaneously Controlling Flow Separation and Transition," supported by Micromechanics, October 2008-June 2009.  
"Support for Development of an Acoustic Holography System (SBIR)," supported by ATA Engineering, August 2008-January 2010.  
"Multipoint Flow and Acoustic Diagnostic Experiments for Source Identification in Supersonic Jets," supported by NASA, Jan 2008 – 2009.  
"Innovative Technologies for Naval Rotorcraft – Ducted Fan Research," supported by Office of Naval Research, April 2007 – 2010.  
"Calibration of a Flow Velocity and Angulation Probe," supported by Tao Systems, May 2007 – 2009.  
"The Reduction of Advanced Military Aircraft Noise," supported by Strategic Environmental Research and Development Program, April 2007 – 2010.  
"A Comprehensive Model for the Prediction of Supersonic Jet Noise," supported by NASA, Jan 2007 - 2010  
"Experiments on the Nonlinear Propagation Phenomena in Supersonic Jet Noise," supported by SERDP, 2002 - 2006.  
"Assessment of Systems for Wake Vortex Detection Including the Radar Acoustic Sounding System (RASS)," supported by the FAA and NASA, 1998-2000, 2003 – 2004.  
"Development of a Simulated Hot Jet Facility for Subsonic and Supersonic Jet Noise," supported by NASA, 1998-2002.  
"Development of Wing in Ground Effect Vehicles," supported by PSU Leonhard Center, 1997-2002.  
"Experiments on the Basic Noise Sources of Centrifugal Fans," supported by Office of Naval Research, 1987-1998.

## MAJOR RESEARCH PROJECTS (Continued):

“Mixing Control in a Supersonic Shear Layer,” supported by ONR, AFOSR, and NASA, 1988-94.

“Development & Ocean Testing of an Internal Gravity Wave Instrument,” supported by ONR, 1982-1985.

“Investigations of Flow-fields in Typical Combustor Geometries,” supported by NASA and NSF, 1980-1986.

“Experiments on Instabilities and Noise Radiated by Supersonic Jets at Low and Moderate Reynolds Numbers,” supported by NSF and NASA, 1972-1997.

## CONTINUING EDUCATION COURSES:

Leadership and Management, a Workshop for leaders of academic departments, presented at the AIAA Aerospace Sciences Meeting, Reno, NV. Jan 2007 and at Penn State, fall 2005; Co-presenters: R.J. Koubek, L.C. Burton and R.P. McNitt

Workshop on the Theory, Computation, and Experiments in Aeroacoustics, presented at the Noise Con meeting of the Institute for Noise Control Engineers, Cleveland, OH, June 2003. Co-presenter with G.C. Lauchle, P.J. Morris and L.N. Long.

Aerodynamically Induced Noise: course via talk-back TV (distance education) to United Technologies and Carrier Corp employees, Spring 1993. Co-taught with P.J. Morris.

Workshop on Development of Aeronautical Engineering Laboratories and Associated Research Projects, Institute of Aeronautics and Astronautics, National Cheng Kung University, Taiwan, June 1985. Co-organizer with D.R.S. Ko.

Wind Energy Systems Workshop, Oklahoma State University October 1976. Lecturer.

Workshop on the Theory and Application of the Laser Doppler Anemometer, Oklahoma State University, June 1973, Co-director with W.G. Tiederman.

## HONORS AND AWARDS:

Elected Fellow of the AIAA, 2004

Who's Who in Engineering Education, 2002

AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Co-winner of the Air Breathing Propulsion Best Paper of the Year Award, 1993.

Certificate of Recognition, NASA Langley Research Center, 1979

Gold Medal in Mechanical Engineering (First in Class), University of Manitoba, 1963

## REVIEWED JOURNAL ARTICLES and BOOK CHAPTERS:

- “Acoustic Measurements of High-Speed Jets Issuing from a Rectangular Nozzle with Thrust Vectoring,”** with A.E. Goss, J. Veltin and J. Lee, accepted for publication in *AIAA Journal*, Jan. 09.
- “Acoustic and Mean Flow Measurements of High-Speed, Helium-Air Mixture Jets,”** with M.J. Doty, in *Jet Aeroacoustics*, Ed. G. Raman, Multi-Science, Essex, UK, 2008, pp. 497-537.
- “Acoustic Pressure Waveforms Measured in High Speed Jet Noise Experiencing Nonlinear Propagation,”** with B.P. Petitjean and K. Viswanathan, *International Journal of Aeroacoustics*, Vol. 5, No. 2, 2006, pp. 193-215.
- “Space-Time Correlation Measurements of High-Speed Axisymmetric Jets Using Optical Deflectometry,”** with M.J. Doty, *Experiments in Fluids*, Vol. 38, 2005, pp. 415-425.
- “Acoustic and Mean Flow Measurements of High-Speed, Helium-Air Mixture Jets,”** with M.J. Doty, *International Journal of Aeroacoustics*, Vol. 2, No. 2, 2003, pp. 293-334.
- “Experiments on the Unsteady Flowfield and Noise Generation in Centrifugal Turbomachinery,”** with J.S. Choi and D.E. Thompson, *Journal of Sound and Vibration* Vol. 263, No. 3, June 2003, pp. 493-514.
- “Experiments on Mach-Wave Interactions in a Compressible Shear Layer,”** with M.J. Doty, *AIAA Journal*, Vol. 38, No. 10, Oct. 2000, pp.1871-1878.
- “Highlights of Aeroacoustics Research in the U.S. - 1998,”** with G. Raman (Editors), *Journal of Sound and Vibration*, Vol. 228, No. 3, 1999, pp.589-610.
- “Measurements of Supersonic Helium/Air Mixture Jets,”** with K. W. Kinzie, *AIAA Journal*, Vol. 37, No. 11, Nov. 1999, pp. 1363-1369.
- “Aeroacoustic Properties of Supersonic Elliptic Jets,”** with K. W. Kinzie, *Journal of Fluid Mechanics*, Vol. 395, 1999, pp. 1-28.
- “Azimuthal Mode Measurements of Elliptic Jets,”** with K.W. Kinzie, *Physics of Fluids*, Vol. 9, No. 7, July 1997.
- “Structure of Coherent Instabilities in a Supersonic Shear Layer,”** with S. Martens, and K.W. Kinzie, *AIAA Journal*, Vol. 34, No. 8, August 1996.
- “A Review of Large Scale Turbulent Structures in Supersonic Jet Flows,”** with K. W. Kinzie, FED Vol. 237, Proceedings of the ASME Fluids Engineering Summer Meeting, July 1996.
- “Numerical Simulations of Flows in Centrifugal Turbomachinery,”** with D.J. Dorney, and R.L. Davis, *AIAA Journal of Propulsion and Power*, Vol. 11, No. 5, Sept./Oct. 1995.
- “Method For Characterizing Aerodynamic Sound Sources in Turbomachines,”** with L. Mongeau, and D.E. Thompson, *Journal of Sound and Vibration*, Vol. 181, No. 3, 1995.
- “Measurements of Kelvin-Helmholtz Instabilities in a Supersonic Shear Layer,”** with S. Martens, and K.W. Kinzie, *AIAA Journal*, Vol. 32, No. 8, August 1994.
- “Experiments on the Instabilities of Swirling Free Jets,”** with J. Panda, *Physics of Fluids*, Vol. 6, No. 1, January 1994.
- “Sound Generation By Rotating Stall in Centrifugal Turbomachines,”** with L. Mongeau, and D.E. Thompson, *Journal of Sound and Vibration*, Vol. 160, No. 4, February 1993.
- “Flow and Acoustic Properties of Low Reynolds Number Underexpanded Supersonic Jets,”** with T. F. Hu, *Journal of Sound and Vibration*, Vol. 141, No. 3, 1990.
- “Mean Flowfields in Axisymmetric Combustor Geometries with Swirl,”** with D. L. Rhode and D. G. Lilley, *AIAA Journal*, Vol. 21, No. 4, 1983.
- “Turbulence Measurements in Confined Jets Using a Rotating Single-Wire Probe Technique,”** with S.I. Janjua, T.W. Jackson and D.G. Lilley, *AIAA Journal*, Vol. 21, No. 2, December 1983.
- “Supersonic Jet Noise Generated by Large-Scale Instabilities,”** with J.M. Seiner and C.H. Liu, NASA Technical Paper 2072, September 1982.
- “Measurements on the Flow and Acoustic Properties of a Moderate Reynolds Number Supersonic Jet,”** with T.R. Troutt, *Journal of Fluid Mechanics*, Vol. 116, 1982.

## MAJOR RESEARCH PROJECTS (Continued):

- "On the Prediction of Swirling Flowfields in Axisymmetric Combustor Geometries,"** with D. L. Rhode and D. G. Lilley, *Transactions of ASME*, Vol. 104, September 1982.
- "Wind Energy Conversion Systems,"** with R. Ramakumar and W.L. Hughes, *Solar Energy Sourcebook*, ed. Kreider, J.F. and Kreith, F., McGraw Hill, 1981.
- "Flowfield and Acoustic Properties of a Mach Number 0.9 Jet at a Low Reynolds Number,"** with J.L. Stromberg and T.R. Troutt, *Journal of Sound and Vibration*, Vol. 72, No. 2, September 1980.
- "The Instability Process in Low Reynolds Number Supersonic Jets,"** with G.L. Morrison, *AIAA Journal*, Vol. 18, No. 7, July 1980.
- "The Noise Generation by Instabilities in Low Reynolds Number Supersonic Jets,"** with G.L. Morrison, *Journal of Sound and Vibration*, Vol. 65, July 1979.
- "Supersonic Hot-Wire Fluctuation Data Analysis with a Conduction End-Loss Correction,"** with C.L. Ko and T.R. Troutt, *Journal of Physics, E, Scientific Instruments*, Vol. 11, May 1978.
- "Wind Power,"** with Wm. L. Hughes, section in the *Standard Handbook for Mechanical Engineers*, 8th Edition, ed. T. Baumeister, McGraw-Hill, April 1978.
- "Reynolds Number Dependence in Supersonic Jet Noise,"** with G.L. Morrison and T.R. Troutt, *AIAA Journal*, Vol. 15, No. 4, April 1977.
- "Hydraulic Modeling of Mixing in Stratified Lakes,"** with P.M. Moretti, *Journal of the Hydraulic Division*, ASCE, Vol. 103, No. HY4, April 1977.
- "Experiments on the Instability Waves in a Supersonic Jet and Their Acoustic Radiation,"** with G.L. Morrison and T.R. Troutt, *Journal of Fluid Mechanics*, Vol. 69, Part 1, April 1975, pp. 73-95.
- "Hot-Wire Measurements in a Supersonic Jet at Low Reynolds Numbers,"** with C. J. McColgan, *AIAA Journal*, Vol. 12, No. 9, September 1974.
- "Biasing Correction for Individual Realization Laser Anemometer Measurements in Turbulent Flow,"** with W.G. Tiederman, *Physics of Fluids*, Vol. 16, No. 12, December 1973, pp. 2082-2088.
- "Individual Realization Laser-Doppler Technique Applied to a Turbulent Channel Flow,"** with W.G. Tiederman and M.M. Reischman, Proceedings of Symposium on Turbulence in Liquids, Rolla, Missouri, September 1973.
- "Turbulence Measurements with a Laser Anemometer Measuring Individual Realizations,"** with G.L. Donohue and W.G. Tiederman, *Physics of Fluids*, Vol. 15, No. 11, November 1972.
- "Experimental Investigation of the Stability of the Laminar Supersonic Cone Wake,"** *AIAA Journal*, Vol. 9, No. 4, April 1971.
- "Experimental Investigation of the Mean Flow of the Laminar Supersonic Cone Wake,"** with J.E. Carter, M. Finston, and J.A. Forney, *AIAA Journal*, Vol. 9, No. 3, March 1971, pp. 479-484.

## MEETING PAPERS (past 20 years):

- Kuo, C., Veltin, J., and McLaughlin, D.K., **"Acoustic Measurements of Models of Military Style Supersonic Nozzle Jets,"** presented at the 47th AIAA Aerospace Sciences Meeting Including The New Horizons Forum and Aerospace Exposition, AIAA Paper 2009-18, Orlando, Florida, Jan. 5 – 8, 2009.
- Veltin, J. and D. K. McLaughlin, **"Flow Field and Acoustic Measurements of Rectangular Supersonic Jets,"** presented at the 47th AIAA Aerospace Sciences Meeting Including The New Horizons Forum and Aerospace Exposition, AIAA Paper 2009-19, Orlando, Florida, January 5 – 8, 2009.
- Veltin, J. and D.K. McLaughlin, **"Noise Mechanisms Investigation in Shock Containing Screeching Jets Using Optical Deflectometry,"** presented at the 14<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2008 – 2889, Vancouver, Canada, May, 2008.

## MEETING PAPERS (Continued):

- Miller, S.A.E., J. Veltin, P.J. Morris and D. K. McLaughlin, “**Validation of Computational Fluid Dynamics for Supersonic Shock Containing Jets,**” presented at the 14<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2008 – 2988, Vancouver, Canada, May, 2008.
- Veltin, J., D.K. McLaughlin, and P.J. Morris, “**Improvement of Acoustic Models for Community Noise Exposure Prediction,**” presented at the 46<sup>th</sup> Annual Aerospace Sciences Meeting and Exhibit, AIAA Paper 2008-0012, Reno, NV, January 7-10, 2008.
- McLaughlin, D.K., C.W. Kuo, and D. Papamoschou, “**Experiments on the Effect of Ground Reflections on Supersonic Jet Noise,**” presented at the 46<sup>th</sup> Annual Aerospace Sciences Meeting and Exhibit, AIAA Paper 2008-0022, Reno, NV, January 7-10, 2008.
- Petitjean, B.P., K. Viswanathan, D.K. McLaughlin and P.J. Morris, “**Space-Time Correlation Measurements in Subsonic and Supersonic Jets Using Optical Deflectometry,**” presented at 13<sup>th</sup> Annual AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2007-3613, Rome Italy, May 21-23, 2007.
- Gandhi, F., T. Prabhakar, and D.K. McLaughlin, “**A Centrifugal Force Actuated Variable Span Morphing Helicopter Rotor,**” presented at the 63<sup>rd</sup> Annual American Helicopter Society Forum, Virginia Beach, VA, May 1-3, 2007.
- Petitjean, B.P., D.K. McLaughlin, and P.J. Morris, “**An Experimental Investigation of Density Gradient Fluctuations in High Speed Jets Using Optical Deflectometry,**” 12th AIAA/CEAS Aeroacoustics Conference, Cambridge MA, May, 2006 AIAA Paper No. 2006-2533.
- Lee J, Goss A, and D.K. McLaughlin, “**Experiments on High Speed Jets from Thrust Vectoring Rectangular Nozzles,**” 12th AIAA/CEAS Aeroacoustics Conference, Cambridge, MA May, 2006 AIAA Paper No. 2006-2704.
- Petitjean, B.P., D.K. McLaughlin, and P.J. Morris, “**On the Nonlinear Propagation of Shock-Associated Jet Noise,**” presented at the 11<sup>th</sup> Annual AIAA/CEAS Aeroacoustics Conference, AIAA Paper No. 2005-2930, Monterey, CA, May 23-25, 2005.
- Petitjean, B.P., K. Viswanathan, and D.K. McLaughlin, “**Acoustic Pressure Waveforms Measured in High Speed Jet Noise Experiencing Nonlinear Propagation,**” 43rd Aerospace Sciences Meeting and Exhibit AIAA Paper 2005-0209, Reno, NV, January 10-13, 2005.
- Tesson, X., B.P. Petitjean, and D.K. McLaughlin, “**Experiments on the Noise Produced by High Speed Jets with Elliptic Exhaust Nozzles,**” 43rd Aerospace Sciences Meeting and Exhibit AIAA Paper 2005-0211, Reno, NV, January 10-13, 2005.
- Gee, K.L., B.P. Petitjean, D.K. McLaughlin, and V.W. Sparrow, “**Nonlinear Propagation of Noise Radiated from Supersonic Jets,**” presented at NOISE-CON 2004, Baltimore, MD, July 12-14, 2004.
- Petitjean, B.P., D.K. McLaughlin, “**Characterizing Acoustic Pressure Waveforms in Jet Noise Experiencing Nonlinear Acoustic Propagation,**” presented at the 10<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2004-3017, Manchester, United Kingdom, May 10-12, 2004.
- Petitjean, B.P. and D.K. McLaughlin, “**Experiments on the Nonlinear Propagation of Noise from Supersonic Jets,**” presented at the 9<sup>th</sup> Annual AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2003-3127, Hilton Head, SC, May 12-14, 2003.

## MEETING PAPERS (Continued):

- Tesson, V., M.J. Doty, and D.K. McLaughlin, "**Experimental Investigation of Jet Noise and Core Noise Using a Small Gas Turbine Engine,**" presented at the 8<sup>th</sup> Annual AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2002-2558, Breckenridge, CO, June 17-19, 2002.
- Doty, M.J. and D.K. McLaughlin, "**Two-Point Correlations and Acoustic Measurements of High-Speed Axisymmetric Jets,**" presented at the 8<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2002-2553, Breckenridge, CO, June 17-19, 2002.
- Doty, M.J. and D.K. McLaughlin, "**Two-Point Correlations of Density Gradient Fluctuations in High Speed Jets Using Optical Deflectometry,**" presented at the 40<sup>th</sup> AIAA Aerospace Sciences Meeting Aeroacoustics, AIAA Paper 2002-0367, Reno, NV, January 14-17, 2002.
- Doty, M.J. and D.K. McLaughlin, "**Two-Point Space Time Correlations in High Speed Jets,**" presented at the 54<sup>th</sup> Annual Meeting of the Div. of Fluid Dynamics, San Diego, CA, Nov., 2001.
- Doty, M.J. and D.K. McLaughlin, "**Supersonic Helium/Air Mixture Jets with Comparison to Heated Jet Experiments,**" presented at the 7<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2001-2186, Maastricht, The Netherlands, May 28-30, 2001.
- Doty, M.J. and D.K. McLaughlin, "**Helium/Air Mixture Jets at Subsonic and Supersonic Speeds,**" presented at the 53<sup>rd</sup> Annual Meeting of APS/DFD, Washington, DC, November 20, 2000.
- Carolus, T.H., D.K. McLaughlin, R. Basile, "**Experimental Investigation of the Unsteady Discharge Flow Field and the Noise of a Centrifugal Fan Impeller,**" presented at the 7th International Congress on Sound and Vibration, Germany, July 4-7, 2000.
- Doty, M.J. and D.K. McLaughlin, "**Experiments on Helium/Air Mixture Jets at High Subsonic Speeds,**" presented at the 6<sup>th</sup> AIAA/CEAS Aeroacoustics Conference, AIAA Paper 2000-2019, Lahaina, Hawaii, June 12-14, 2000.
- Doty, M.J. and D.K. McLaughlin, "**Experiments on Mach Wave Interactions in a Compressible Mixing Layer,**" presented at the 35<sup>th</sup> AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, AIAA Paper 99-2105, Los Angeles, CA, June 20-24, 1999.
- Raman, G. and D.K. McLaughlin, "**Highlights of Aeroacoustics Research in the U.S. – 1998,**" presented at the 5<sup>th</sup> AIAA/CEAS Aeroacoustics Conf., Paper 99-1915, Seattle, WA, May 10-12, 1999.
- Kinzie, K.W., and D.K. McLaughlin, "**Measurements of Supersonic Helium/Air Mixture Jets,**" presented at the AIAA/CEAS Aeroacoustics Conf., Paper 98-2328, Toulouse, France, June 2-4, 1998.
- McLaughlin, D. K., and K.W. Kinzie, "**A Review of Large Scale Turbulent Structures in Supersonic Jet Flows,**" invited paper for presentation at the ASME Fluids Engineering Conference, San Diego, CA, July 7-11, 1996.
- Kinzie, K.W. and D.K. McLaughlin, "**An Azimuthal Modal Decomposition Measurement Technique for Elliptic Jets,**" presented at the 2nd AIAA/CEAS Aeroacoustics Conference, AIAA Paper 96-1669, State College, PA, May 6-8, 1996.

## MEETING PAPERS (Continued):

- Tetu, L.G., D.E. Thompson and D.K. McLaughlin, "**Noise Produced By Large Scale Instability Modes in Centrifugal Turbomachinery,**" presented at the ASME '95 International Mechanical Engineering Congress and Exposition (IMECE), San Francisco, CA, November 12-17, 1995.
- Martens, S., D.P. Lockard, P.J. Morris, and D.K. McLaughlin, "**An Experimental and Analytical Investigation of the Large Scale Instabilities in a Supersonic Shear Layer,**" presented at the Tenth Symposium on Turbulent Shear Flows, University Park, PA, August 14-16, 1995.
- Martens, S. and D.K. McLaughlin, "**Mixing Enhancement Using Mach Wave Interaction In A Confined Supersonic Shear Layer,**" presented at the AIAA 26th Fluid Dynamics Conference, AIAA 95-2177, San Diego, CA, June 19-22, 1995.
- Kinzie, K.W., and D.K. McLaughlin, "**Noise Radiated From Asymmetric Supersonic Jets,**" presented at the 1st Joint CEAS/AIAA Aeroacoustics Conference, CEAS/AIAA 95-014, Munich, Germany, June 12-15, 1995.
- Kinzie, K.W. and D.K. McLaughlin, "**An Experimental Study of Noise Radiated from Supersonic Elliptic Jets,**" presented at the 33rd Aerospace Sciences meeting and Exhibit, AIAA Paper 95-0511, Reno, NV, January 9-12, 1995.
- Martens, S., K.W. Kinzie, and D.K. McLaughlin, "**Wave Structure of Coherent Instabilities In a Planar Supersonic Shear Layer,**" presented at the AIAA 32nd Aerospace Sciences Meeting, AIAA Paper 94-0822, Reno, NV, January 10-13, 1994.
- Bent, P.H., D.K. McLaughlin, and D.E. Thompson, "**Identification on Non-Tonal Noise Sources in Centrifugal Turbomachinery,**" presented at the ASME Winter Annual Meeting, New Orleans, LA, Nov. 28 - Dec. 3, 1993.
- Bent, P.H., and D.K. McLaughlin, "**Enhancements to Noise Source Measurement Techniques for Turbomachinery,**" presented at the 15th AIAA Aeroacoustics Conference, AIAA Paper 93-4373, Long Beach, CA, October 25-27, 1993.
- Tetu, L.G., D.E. Thompson, and D.K. McLaughlin, "**Aeroacoustic Similarity of Centrifugal Turbomachinery of Different Geometries,**" presented at the 15th AIAA Aeroacoustics Conference, AIAA Paper 93-4371, Long Beach, CA, October 25-27, 1993.
- Kinzie, K.W., S. Martens, and D.K. McLaughlin, "**Supersonic Elliptic Jet Noise: Experiments With and Without an Ejector Shroud,**" presented at the 15th AIAA Aeroacoustics Conference, AIAA Paper 93-4349, Long Beach, CA, October 25-27, 1993.
- Dorney, D.J., R.L. Davis, and D.K. McLaughlin, "**Numerical Simulations of Flows in Centrifugal Turbomachinery,**" AIAA/SAE/ASME/ASEE 29th Joint Propulsion Conference and Exhibit, AIAA Paper 93-2578, Monterey, CA, June 28-30, 1993.
- Bent, P.H., D.K. McLaughlin, and D.E. Thompson, "**The Influence of Discharge Configuration on the Generation of Broadband Noise in Centrifugal Turbomachinery,**" 14th Aeroacoustics Conference, DGLR/AIAA Paper 92-02-099, Aachen, Germany, May 11-14, 1992.
- McLaughlin, D.K., W.D. Barron, and A.R. Vaddempudi, "**Acoustic Properties of Supersonic Helium/Airjets at Low Reynolds Numbers,**" 14th Aeroacoustics Conference, DGLR/AIAA 92-02-047, Aachen, Germany, May 11-14, 1992.



**MEETING PAPERS (Continued):**

McLaughlin, D.K., S. Martens, and K.W. Kinzie, "**An Experimental Investigation of Large Scale Instabilities in a Low Reynolds Number Two-Stream Supersonic Shear Layer,**" AIAA 30th Aerospace Sciences Meeting & Exhibit, AIAA Paper 92-0177, Reno, NV, January 6-9, 1992.

Choi, J.S., D.K. McLaughlin, and D.E. Thompson, "**Experiments on the Aerodynamic Noise Sources in Centrifugal Turbomachinery,**" AIAA 13th Aeroacoustics Conference, AIAA Paper 90-3948, Tallahassee, FL, October 22-24, 1990.

Mongeau, L., D.E. Thompson, and D.K. McLaughlin, "**Analysis of Turbomachinery Noise Using Similarity Laws,**" 119th ASA Meeting, University Park, PA, May 21-25, 1990.

Panda, J. and D.K. McLaughlin, "**Experiments on the Instabilities in a Free Swirling Jet,**" AIAA 28th Aerospace Sciences Meeting, AIAA Paper 90-0506, Reno, NV, January 8-11, 1990.

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