Peter Vorobieff
Curriculum Vitæ

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Department of Mechanical Engineering
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Research Interests

- Fluid instabilities and turbulence
- Wake flows
- Shock-accelerated flows
- Two-dimensional hydrodynamics
- Multiphase flows
- Granular media
- 2D and 3D flow visualization
- Topological flow classification and decomposition
- Advanced flow field measurement techniques

EXPERIENCE

2005 – ... **Associate Professor,** The University of New Mexico, Albuquerque, New Mexico.

1999 – 2005 **Assistant Professor,** The University of New Mexico, Albuquerque, New Mexico. Developed a program of experimental studies of hydrodynamic instabilities in two and three dimensions. Built state-of-the-art experimental facilities (soap-film tunnel, tow tank) and diagnostic systems. Supervised award-winning undergraduate (D. Georgiev, J. Vigil, 2001) and graduate (A. Palekar, 2004, S. Gogte, 2005) research.

1996 – 1999 **Research Associate**, Los Alamos National Laboratory, Los Alamos, New Mexico. Conducted experimental studies of fluid instabilities and turbulence. Demonstrated feasibility of applying particle-image velocimetry (PIV) diagnostic to shock-accelerated flows. Developed a state-of-the-art scanning digital PIV system for investigation of turbulent rotating convection. Designed the first PIV system for velocity field measurements in flowing soap films. Supervised two graduate students.

1995–1996 **Research Assistant**, Lehigh University, Bethlehem, Pennsylvania.
Conducted research in fluid mechanics in the areas of vortex dynamics, wakes, separated flows, visualization techniques. Developed software applications for numerically intensive experimental data processing and analysis. Proposed and implemented a new mathematical method of identification of topological features of fluid flows via wavelet filtering. Demonstrated a new energetically efficient technique of stall control on delta wings – intermittent trailing-edge blowing.

1992-1995 **Teaching Assistant**, Lehigh University, Bethlehem, Pennsylvania.
Conducted laboratory workshops, supervised undergraduate projects. Designed and programmed computer interface for a series of laboratory experiments in mechanical vibrations.

1991-1992 **Interpreter/Programmer**, Association of Space Explorers, Moscow, Russia.
Developed code and computer graphics for an educational computer game and several computer videos, performed synchronous Russian/English translation.

1989-1991 **Research Assistant**, Institute for High Temperatures, Moscow, Russia.
Conducted research in theoretical gas dynamics (laser propulsion). Developed code for numerical simulation programs. Performed the duties of UNIX system administrator.

EDUCATION

Lehigh University, Bethlehem, Pennsylvania. Ph.D. Mechanical Engineering, May 1996.
Research combining experimental fluid dynamics and applied mathematics. GPA 4.0. Dissertation: "Vortex breakdown on a maneuvering delta wing and related issues of flow analysis and topology."

M.V. Lomonosov Moscow State University, Moscow, Russia. M.S. Mechanical Engineering and Applied Mathematics, May 1989. Cum Laude.
Development of analytical methods applicable to a wide range of problems. GPA 4.0. Thesis: "On averaging parabolic equations."

SKILLS

Experience of designing, building and operating custom PIV (particle image velocimetry) velocity field acquisition and TLC (thermochromic liquid crystal) temperature visualization systems for experiments in gas and fluid dynamics. Expert knowledge of water tunnel, tow tank, wind tunnel and shock tube experimental system operation.
Expert knowledge of PC hardware and software (Windows, Linux, OpenBSD, CygWin), and of UNIX workstations: SGI, IBM, Sun. C, C++, FORTRAN, Poco, HTML, XML, Java, Javascript, Perl.

HONORS

2001 American Physical Society ***Gallery of Fluid Motion*** winner, APS-DFD 2001 Meeting. With K.P. Prestridge and others.
Junior Faculty Research Excellence Award, School of Engineering, The University of New Mexico.

1999 Los Alamos National Laboratory ***DX Division Teamwork Award*** (with R.F. Benjamin, P.M. Rightley, and K.P. Prestridge).

1998 American Physical Society ***Gallery of Fluid Motion*** winner, APS-DFD 1998 Meeting. With D. Blair and I. Aronson.

1996 American Physical Society ***Gallery of Fluid Motion*** winner, APS-DFD 1996 Meeting. With P.M. Rightley and R.F. Benjamin.

1995 ***S.W. Kung Award*** for best graduate research, Lehigh University, Bethlehem, Pennsylvania.

1992 ***Galactic Empire Award*** for best science fiction novel in Russian.

1989 ***Lomonosov scholarship***, Moscow University.

1988 ***Chebyshev scholarship***, Moscow University.

Service Refereed for: AIAA Journal, Experiments in Fluids, International Journal of Imaging Systems and Technology, Journal of Fluid Mechanics, Journal of Fluids Engineering, Physical Review E, Physical Review Letters. Membership: American Physical Society, Pi Tau Sigma (local chapter coordinator), Engineers Without Borders (faculty advisor of local chapter). Organizer of the *Nonlinear Phenomena and Dynamic Systems* workshop, Apr. 30-May 2, 1998, Boulder, CO. Minisymposium chair at the *13th Canadian Symposium on Fluid Dynamics* (CSFD), May 26-30, 1998, Vancouver, BC, Canada. Session chair at the 1998, 2006, 2007 American Physical Society – Division of Fluid Dynamics Meetings.

Graduate Students Jonathan Gallegos, M.S. (2001), Nagoor-Gani Mohamed, M.S. (2003), Tanveer Shakeel, M.S. (2003), Ph.D. (2006), Chris Platero[1], M.S. (2003), Kathy Meyer[1], M.S. (2003), Richard Truesdell, Ph.D. (2006, co-advised with A.A. Mammoli), Charlie Booker, M.S. (2006). Aparna Korlimarla, M.S. (2006), Greg Orlicz, M.S. (2007), Daniel Coughlin, M.S. (2008), Carrie Noren[1], Ph. D. (2008)

[1] Co-advised with C.R. Truman.

PUBLICATIONS (technical only)[2]

Review Papers

1. P. Vorobieff, S. Kumar, "Experimental studies of Richtmyer-Meshkov instability," *Recent Research Developments in Fluid Dynamics* Vol. 5 (2004), pp. 33-55 [1].

Reviewed Journals and Proceedings

In this section, publications are first organized by journal, in descending order of journal impact factor (2006 ISI data, as indicated in round brackets after journal name).

Nature (26.68)

2. K. Mertens, V. Putkaradze, and P. Vorobieff, "Braiding patterns on an inclined plane," *Nature* Vol. 430, No. 6996 (2004), p. 165 [2].

Physical Review Letters (7.07)

3. M.K Rivera, P. Vorobieff, and R.E. Ecke, "Turbulence in Flowing Soap Films: Velocity, Vorticity and Thickness Fields," *Physical Review Letters* Vol. 81 No. 7 (1998), pp. 1417-1420 [46].

4. P. Vorobieff, P.M. Rightley, and R.F. Benjamin, "Power-law Spectra of Incipient Gas-Curtain Turbulence," *Physical Review Letters* Vol. 81 No. 11 (1998), pp. 2240-2243 [6].

5. K.P. Prestridge, P.M. Rightley, P. Vorobieff, and R.F. Benjamin, "Validation of an Instability Growth Model Using PIV Measurements," *Physical Review Letters* Vol. 84 No. 19 (2000), pp. 4353-4356 [9].

6. E. Ben-Naim, Z.A. Daya, P. Vorobieff, and R.E. Ecke, "Knots and random walks in vibrated granular chains," *Physical Review Letters* Vol. 86 No. 8 (2001), pp. 1414-1417 [32].

7. R. Truesdell, A. Mammoli, P. Vorobieff, F van Swol, and C.J. Brinker, "Drag reduction on a patterned superhydrophobic surface," *Physical Review Letters* Vol. 97 No. 4 (2006), pp. 044504-1–044504-4 [11].

8. V. Putkaradze and P. Vorobieff, "Instabilities, Bifurcations, and Multiple Solutions in Expanding Channel Flows," *Physical Review Letters* Vol. 97 No. 14 (2006), pp. 144502-1–144502-4.

9. B. Birnir, K. Mertens, V. Putkaradze, and P. Vorobieff, "Meandering fluid streams in the presence of flow rate fluctuations," *Physical Review Letters* Vol. 101 No. 11 (2008), pp. 114501-1–114501-4.

Physical Review E (2.44)

10. P. Vorobieff and R.E. Ecke, "Cylinder Wakes in Flowing Soap Films," *Physical Review E* Vol. 60 No. 3 (1999), pp. 2953-2956 [19].

11. R.A. Truesdell. P.V. Vorobieff, L.A. Sklar, and A.A. Mammoli, "Mixing of a continuous flow of two fluids due to unsteady flow," *Physical Review E* Vol. 67, No. 6 (2003), pp. 066304-01–066304-11 [10].

12. P. Vorobieff, N.-G. Mohamed, C. Tomkins, C. Goodenough, M. Marr-Lyon, and R.F. Benjamin, "Scaling evolution in shock-induced transition to turbulence," *Physical Review E* Vol. 68, No. 6 (2003), pp. 066304-1–066304-4 [8].

13. M. Popova, P. Vorobieff, M.S. Ingber, and A.L. Graham, "Interaction of two particles in a shear flow," *Physical Review E* Vol. 75 no. 6 (2007), pp. 66309-1–66309-5.

[2]Numbers in square brackets indicate number of times cited (according to ISI Citation index or Google Scholar Citation index), if known.

Journal of Rheology (2.08)

14. M.S. Ingber, A.A. Mammoli, P. Vorobieff, T. McCollam, and A.L. Graham, "Experimental and numerical analysis of irreversibilities among particles suspended in a Couette device," *Journal of Rheology* Vol. 50 (2006), pp.99-114 [2].

Journal of Fluid Mechanics (2.02)

15. P. Vorobieff and R.E. Ecke, "Turbulent Rotating Convection: an Experimental Study," *Journal of Fluid Mechanics* Vol. 458 (2002), pp. 191-218 [7].

16. K. Mertens, V. Putkaradze, and P. Vorobieff, "Morphology of a stream flowing down an inclined plane. Part 1. Braiding," *Journal of Fluid Mechanics* Vol. 531 (2005), pp. 49-58 [2].

17. B. Birnir, K. Mertens, V. Putkaradze, and P. Vorobieff, "Morphology of a stream flowing down an inclined plane. Part 2: Meandering," *Journal of Fluid Mechanics* Vol. 607 (2008), pp. 401-411.

Physics of Fluids (1.70)

18. J.-C. Lin, P. Vorobieff, and D.O. Rockwell, "Space-Time Imaging of a Turbulent Near-Wake by High-Image-Density Particle Image Cinematography," *Physics of Fluids* Vol. 8 No. 2 (1996), pp. 555-564 [12].

19. P.M Rightley, P. Vorobieff,and R.F. Benjamin, "Evolution of a Shock-Accelerated Thin Fluid Layer," *Physics of Fluids* Vol. 9 No. 6 (1997), pp. 1770-1782 [29].

20. P.M. Rightley, P. Vorobieff, and R.F. Benjamin, "Mushrooms+Snakes: an investigation of Richtmyer-Meshkov instability," *Physics of Fluids* Vol. 9 No. 9 (1997), Special Section p. S6.

21. P. Vorobieff and R.E. Ecke, "Transient States During Spin-Up of a Rayleigh-Bénard Cell," *Physics of Fluids* Vol. 10 No. 10 (1998), pp. 2525-2538 [2].

22. P.M. Rightley, P.Vorobieff, R. Martin, and R.F. Benjamin, "Experimental Observations of the Mixing Transition in a Shock-Accelerated Gas Curtain," *Physics of Fluids* Vol. 11 No. 1 (1999), pp. 186-209 [29].

23. P. Vorobieff, M.K. Rivera, and R.E. Ecke,"Soap Film Flows: Statistics of two-dimensional Turbulence," *Physics of Fluids* Vol. 11 No. 8 (1999), pp. 2167-2177 [22].

24. I. Aranson, D. Blair, and P. Vorobieff, "Interface Nucleation in Vibrating Granular Media," *Physics of Fluids* Vol. 11 No. 9 (1999), p. S9.

25. K.P. Prestridge, C. Tomkins, P. Rightley, P. Vorobieff, and R.F. Benjamin, "The Courtship and Mating Rituals of Vortices," *Physics of Fluids*, Vol. 14 No. 9 (2002), p. S10.

26. P. Vorobieff, D. Georgiev, and M.S. Ingber, "Onset of the second wake in two dimensions: Dependence on the Reynolds number," *Physics of Fluids*, Vol. 14 No. 7 (2002), pp. L53-L56 [1].

27. C. Tomkins, K. Prestridge, P. Rightle, M. Marr-Lyon, P. Vorobieff, and R.F. Benjamin, "A quantitative study of the interaction of two Richtmyer-Meshkov unstable gas cylinders," *Physics of Fluids* Vol. 15 No. 4 (2003), pp. 986-1004 [13].

28. S. Gogte, P. Vorobieff, R. Truesdell, A. Mammoli, F. van Swol, P. Shah, and C.J. Brinker, "Effective slip on textured superhydrophobic surfaces," *Physics of Fluids* Vol. 17 (2005), pp. 051701-1–051701-4 [22].

29. S. Kumar, G. Orlicz, C. Tomkins, C. Goodenough, K. Prestridge, P. Vorobieff, and R. Benjamin, "Stretching of material lines in shock-accelerated gaseous flows," *Physics of Fluids* Vol. 17 (2005), pp. 082107-1–082107-11 [5].

Physica D – Nonlinear Phenomena (1.67)

30. P. Vorobieff and R.E. Ecke, "Vortex Structure in Rotating Rayleigh-Bénard Convection," *Physica D* (Amsterdam) Vol. 123 (1998), pp. 153-160 [9].

31. P. Vorobieff, P.M. Rightley, and R.F. Benjamin,"Shock-driven Gas Curtain: Fractal Dimension Evolution in Transition to Turbulence," *Physica D* (Amsterdam) Vol. 133, pp. 469-476 (1999) [7].

32. S. Kumar,P. Vorobieff,G. Orlicz, A. Palekar,C. Tomkins, C. Goodenough, M. Marr-Lyon, K.P. Prestridge, and R.F. Benjamin, "Complex flow morphologies in shock-accelerated gaseous flows," *Physica D* (Amsterdam) Vol. 235 no. 1-2 (2007), pp. 21–28 [1].

Other refereed publications

33. V.S. Vorob'ev, P.V. Vorob'ev, "Odnomernyj razlet sloya isparivshegosya veschestva v pustotu," *Teplofizika vysokih Temperatur* vol. 30 No. 1 (1992), pp. 122-131.

34. J.-C. Lin, P. Vorobieff, and D.O. Rockwell,"Three-Dimensional Patterns of Streamwise Vorticity in the Turbulent Near-Wake of a Cylinder," *Journal of Fluids and Structures* Vol. 9 (1995), pp. 231-234 [15].

35. P. Vorobieff and D.O. Rockwell, "Multiple-Actuator Control of Vortex Breakdown on a Pitching Delta Wing," *AIAA Journal* Vol. 34 No. 10 (1996), pp. 2184-2186 [13].

36. P. Vorobieff and D.O. Rockwell, "Wavelet Filtering for Topological Decomposition of Flow Fields," *International Journal of Imaging Systems and Technology*, Vol. 7 No. 3 (1996), pp. 211-214 [3].

37. P. Vorobieff and D.O. Rockwell, "Vortex Breakdown on Pitching Delta Wing: Control by Intermittent Trailing-Edge Blowing," *AIAA Journal* Vol. 34 No. 10 (1998), pp. 2184-2186 [19].

38. P. Vorobieff and R.E. Ecke, "Flow Structure in a Rayleigh-Bénard cell upon impulsive spin-up," *Journal of Fluids Engineering* Vol. 120 (1998), pp. 672-675.

39. P. Vorobieff and R.E. Ecke, "Fluid Instabilities and Wakes in a Soap-Film Tunnel," *American Journal of Physics* Vol. 67 No. 5 (1999), pp. 394-399 [7].

40. K.P. Prestridge, P.M. Rightley, P. Vorobieff, N.A. Kurnit, and R.F. Benjamin, "Simultaneous Density-Field Visualization and PIV of a Shock-Accelerated Gas Curtain," *Experiments in Fluids* Vol. 29 No. 4 (2000), pp. 339-346 [8].

41. P. Vorobieff, M.K. Rivera and R.E. Ecke, "Imaging 2D Turbulence," *Journal of Visualization* Vol. 3 No. 4 (2001), pp. 323-330 [2].

42. J.R. Kamm, W.J. Rider, P.M. Rightley, K.P. Prestridge, R.F. Benjamin, and P.V. Vorobieff, "The gas curtain experimental technique and analysis methodologies," *Computational Methods in Experimental Measurements X*, editors: Y. Villacampa Esteve, G.M. Carlomagno, and C.A. Brebbia, WIT Press, Southampton, UK (2006), 10 pp. [3].

43. W. Rider, J. Kamm, P. Rightley, K. Prestridge, R. Benjamin, and P. Vorobieff, "Direct statistical comparison of hydrodynamic mixing experiments and simulations," *Computational Methods in Experimental Measurements X*, editors: Y. Villacampa Esteve, G.M. Carlomagno, and C.A. Brebbia, WIT Press, Southampton, UK (2006), 10 pp.

44. D. Georgiev and P. Vorobieff, "The slowest soap-film tunnel in the Southwest," *Review of Scientific Instruments* Vol. 73 No. 3 (2002), pp. 1177-1184 [7].

45. C. Tomkins, P. Rightley, P. Vorobieff, K.P. Prestridge, and R.F. Benjamin, "Flow Morphologies of Two Shock-Accelerated, Unstable Gas Cylinders," *Journal of Visualization* Vol. 5 No. 3 (2002), pp. 273-283 [1].

46. P. Vorobieff, D. Georgiev, and T. Shakeel, "Bluff-body wake evolution and interaction in two dimensions," *Advances in Fluid Mechanics IV* (2002), editors: M. Rahman, R. Verhoeven, and C.A. Brebbia, WIT Press, Southampton, UK.

47. P. Vorobieff, C. Tomkins, S. Kumar, C. Goodenough, N.-G. Mohamed, and R.F. Benjamin, "Secondary instabilities in shock-induced transition to turbulence," *Advances in Fluid Mechanics V*, editors: C.A. Brebbia, A. Mendes, and M. Rahman, WIT Press, Southampton, UK (2004), pp. 139-148 [3].

48. A.A. Mammoli, P. Vorobieff, and D. Menicucci, "Promoting solar thermal design the Mechanical Engineering building at the University of New Mexico," *Management of Natural Resources, Sustainable Development and Ecological Hazards*, editors: C.A. Brebbia, M.E. Conti, and E. Tiezzi, WIT Press, Southampton, UK (2006), pp. 265-274.

49. T. Shakeel and P. Vorobieff, "Decaying turbulence in soap films: energy and enstrophy evolution," *Experiments in Fluids* Vol. 43 no. 1 (2007), pp. 125–133.

50. A. Palekar, P. Vorobieff, and C.R. Truman, "Two-dimensional simulation of a shock-accelerated gas cylinder," *Progress in Computational Fluid Dynamics* Vol. 7 no. 8 (2007), pp. 427–438.

51. M. Popova, P. Vorobieff, and M. Ingber, "Analysis of two- and three-particle motion in a Couette cell," *Computational Methods in Multiphase Flow IV*, editors: A.A. Mammoli, C.A. Brebbia, WIT Press, Southampton, UK (2007), pp. 315-324.

Conference Papers

52. V.S. Vorob'ev, P.V. Vorob'ev, "One-dimensional expansion of matter vaporized due to laser double-pulse interaction into vacuum," *International Workshop on Strong Shock Waves, Jul. 1991, Chiba, Japan*, pp. 85-96.

53. P. Rightley, P. Vorobieff, and R.F. Benjamin, "Experimental benchmarks: recent data from gas curtain experiments," *Proceedings of NECDC Meeting, Oct. 22-25, 1996, San Diego, California.*

54. P. Vorobieff, P.M. Rightley, and R.F. Benjamin, "Growth rate and transition to turbulence of a gas curtain," *6th IWPCTM Workshop Proceedings, Jun. 18-21, 1997, Marseille, France* [2].

55. P. Vorobieff, P.M. Rightley, and R.F. Benjamin,"Benchmark instability and mix data from gas curtain experiments," *Proceedings of NEDPC Meeting, Oct. 22-25, 1997, Livermore, California.*

56. P. Vorobieff and R.E. Ecke, "Regular and chaotic flow patterns upon impulsive spin-up of a Rayleigh-Bénard convection cell," *Proceedings of the 4th Experimental Chaos Conference, Aug. 6-8, 1997, Boca Raton, Florida* (World Scientific/Singapore), pp. 129-134.

57. P.M. Rightley, P. Vorobieff, K.P. Prestridge, J. Guzik, and R.F. Benjamin, "Experimental gas-curtain results for hydrocode validation," *Proceedings of NECDC Meeting, Oct. 26-30, 1998, Las Vegas, Nevada.*

58. P. Vorobieff, K. Prestridge, R.F. Benjamin, and P.M. Rightley "Shock-driven mixing transition: quantitative analysis," *Proceedings of the 22nd International Symposium on Shock Waves, July 18-23, 1999, Imperial College, London, UK.*

59. P. Vorobieff, R.E. Ecke, "Growth of disordered features in two-dimensional cylinder wake," *Proceedings of the 5th Experimental Chaos Conference, June 28- July 1, 1999, Orlando, Florida* (World Scientific/Singapore), pp. 395-402.

60. K. Prestridge, P. Vorobieff, P.M. Rightley, and R.F. Benjamin, "PIV measurements of a shock-accelerated fluid instability," *Proceedings of 24th International Congress on High-speed Photography and Photonics, Sendai, Japan, Sep.24-29, 2000*, pp. 1-20.

61. C. Tomkins, K. Prestridge, C. Zoldi, P. Rightley, P. Vorobieff, and R. Benjamin, "An investigation of shock-accelerated, unstable gas cylinders using simultaneous density-field visualization and PIV," *Proceedings of 4th International Symposium on Particle Image Velocimetry (PIV 01), Göttingen, Germany, Sept. 17-19, 2001*, pp. 1-6.

62. P. Chavez, C.R. Truman, K.T. Christensen, P. Vorobieff,"Laser Wavefront diagnostics of a heated mixing layer," AIAA-2002-2270, *Proceedings of 33rd Plasmadynamics and Lasers Conference, May 20-23, 2002, Maui, Hawaii*, pp. 1-17.

63. A. Palekar, C.R. Truman, and P. Vorobieff, "Prediction of Transverse Injection of a Sonic Jet in Supersonic Crossflow," AIAA-2005-5366, *Proceedings of 36th AIAA Plasmadynamics and Lasers Conference*, Toronto, Ontario, June 6-9, 2005, pp. 1-12.

64. C. Noren, G. Rothschopf, T. Perschbacher, T. Madden, G. Hager, C. Truman, and P. Vorobieff, "PLIF Flow Visualization of a Supersonic Injection COIL Nozzle," AIAA-2005-5388, *Proceedings of 36th AIAA Plasmadynamics and Lasers Conference*, Toronto, Ontario, June 6-9, 2005, pp. 1-10 [1].

65. C. Goodenough, S. Kumar, M. Marr-Lyon, A. Boyts, K. Prestridge, P. Rightley, C. Tomkins, M. Cannon, J. Kamm, W. Rider, C. Zoldi-Sood, G. Orlicz, and P. Vorobieff, "Planar velocity and scalar concentration measurements in shock-accelerated unstable fluid interfaces," *Proceedings of SPIE – Volume 5580: 26th International Congress on High-Speed Photography and Photonics, March 2005*, pp. 186-192.

66. S. Gogte, P. Vorobieff,and A. Mammoli, "Drag reduction on a textured hydrofoil with superhydrophobic coating," AIAA-2006-0355, *Proceedings of AIAA Region IV Student Conference*, Albuquerque, New Mexico, April 7-9, 2005.

67. C.A. Noren, C.R. Truman, P.V. Vorobieff, T.J. Madden, and G.D. Hager, "PLIF visualization and quantitative mixing measurements of a supersonic injection nozzle," AIAA-2006-2895. *Proceedings of 37th AIAA Plasmadynamics and Lasers Conference 5 - 8 June 2006, San Francisco, California.*

68. S.R. Challa, R. Truesdell, P. Vorobieff, A Mammoli, and F. van Swol, "Shear flow on superhydrophobic surfaces," *AIP Conference Proceedings* Vol. 973, Feb. 15, 2008, pp. 912-918.

69. C.A. Noren, C.R. Truman, P.V. Vorobieff, and T.J. Madden, "Quantitative mixing measurements of a supersonic injection COIL nozzle with trip jets," AIAA-2008-3881, *Proceedings of 39th AIAA Plasmadynamics and Lasers Conference*, Seattle, Washington, June 23-26, 2008.

Reports

70. P. Vorobieff and R.E. Ecke, "Evidence of 2D turbulence," Los Alamos National Laboratory *CNLS Newsletter*, February 1998.

71. P. Vorobieff, C.R. Truman, and J. Gallegos,"PIV diagnostics for flow control applications," *Proceedings of 2000 Contractors' Meeting in Turbulence and Rotating Flows*, Air Force Office of Scientific Research, Arlington, VA, pp. 285-289.

72. P. Vorobieff, C.R. Truman, J. Gallegos, and P. Chavez, "PIV diagnostics for flow control applications: Part 2," *Proceedings of 2001 Contractors' Meeting in Turbulence and Rotating Flows*, Air Force Office of Scientific Research, Arlington, VA, pp. 227-232.

73. C.A. Noren, G. Rothschopf, T. Perschbacher, T.J. Madden, G.D. Hager, C.R. Truman, and P.V. Vorobieff, "PLIF Flow Visualization of a Supersonic Coil Nozzle," *Air Force Research Lab Kirtland AFB NM Directed Energy Directorate Report* A655174, Oct. 16, 2006, pp. 1-9.

74. P. Vorobieff and C.R. Truman, "Prediction of chemical laser flow," *Final Report on US DOD/DOI Contract No. FA95500510031*, Apr. 14, 2006, pp. 1-25.

Total number of citations (including references to Ph.D. dissertation and conference papers): more than 400.

Invited presentations

1. "Kraichnan was right! 2D turbulence," poster presentation. Presented at the *Turbulence: Challenges for the 21st Century* conference, May 18-21, 1998, Los Alamos, New Mexico. With R.E. Ecke.

2. "Phenomenology and statistics of 2D turbulence," presented at the *13th Canadian Symposium on Fluid Dynamics* (CSFD), May 26-30, 1998, Vancouver, Canada.

3. "Fluid instabilities and turbulence: some experimental results," presented at the seminar of the Mechanical Engineering Department, University of New Mexico, Sep. 15, 1998, Albuquerque, New Mexico.

4. "Fluid instability and turbulence studies via PIV," presented at the seminar of the Department of Theoretical and Applied Mechanics, University of Illinois, Sep. 24, 1998, Urbana, Illinois.

5. "Experiments in fluid turbulence," presented at the University of California, San Diego Physics Seminar, Jan. 18, 1999, San Diego, California.

6. "Interface motion in a vibrated granular layer," video presentation. Presented at the *Centennial Meeting of the American Physical Society*, March 20-26, 1999, Atlanta, Georgia. With D. Blair and I. Aronson.

7. "Dynamics of shock-accelerated density interfaces," presented at the *Dynamics of Interfaces, Patterns and Domains '99 International Workshop*, April 22-24, 1999, Los Alamos, New Mexico.

8. "Wakes in soap films," presented at the *5th Experimental Chaos Conference*, June 28-July 1, 1999, Orlando, Florida.

9. "Experiments in nonlinear science," presented at Santa Fe Institute with R.E. Ecke, 1999, 2000.

10. "Quasi-two-dimensional studies in gravity-driven soap films," presented at Eötvös University (Physics Department) Graduate Student Seminar, Budapest, Hungary, June 2001.

11. "Bluff-body wake evolution and interaction in 2D," presented at the *4th International conference on Advances in Fluid Mechanics (AFM2002)*, Ghent, Belgium, May 14-17, 2002. With D. Georgiev and T. Shakeel.

12. "Experimental studies of shock-driven instabilities," presented at the Washington University in St. Loius (MAE Department) Graduate Student Seminar, St. Louis, Missouri, USA, Oct. 30, 2003.

13. "Experiments in impulsively-driven instabitities," presented at the Fluid Mechanics Series seminar, California Institute of Technology, Pasadena, California, USA, Apr. 23, 2004.

14. "Shock-driven transition to turbulence: curiouser and curiouser," presented at the Special Session on Mathematical Methods in Turbulence, Fall Western Section Meeting of the American Mathematical Society, Albuquerque, New Mexico, USA, Oct. 17, 2004,

15. "Richtmyer-Meshkov instability," presented at the University of Victoria, Victoria, British Columbia, Canada, June 30, 2006.

16. "Irreversibility and chaos in shear flow carrying particles," presented at the 2007 Spring Western Section Meeting of the American Mathematical Society, Special Session on Subjects in and Around Fluid Dynamics, Tucson, Arizona, USA, Apr. 22, 2007.

17. "Turbulence in two, three, and one dimension," presented at the Institute for High Temperatures, Russian Academy of Sciences, Moscow, Russia, June 21, 2007,

18. "Turbulence and spatial dimensionality," keynote presentation at Russian Low-Temperature Plasma Conference, St. Petersburg – Petrozavodsk, Russia, June 26, 2007.

19. "Quasi-two-dimensional turbulent decay and fossil turbulence," presented at the Fall Western Section Meeting of the American Mathematical Society, Special Session on Recent Developments in 2-D Turbulence, Albuquerque, New Mexico, USA, Oct. 13, 2007.

Funded Research (partial list)

Title:	Quantification of Disorder Growth in Transition to Turbulence
PIs:	P. Vorobieff
Funding Agency:	Sandia National Laboratories
Start Date:	10/01/1999
End Date:	09/30/2000
Funding Level:	$ 29,073
Summary:	Develop advanced analysis methods using summation concepts for studies of disorder growth in pre-turbulent mixing flows.

Title:	PIV Diagnostics for Flow Control Applications
PIs:	P. Vorobieff (PI), C.R. Truman (co-PI)
Funding Agency:	AFOSR
Start Date:	03/31/2000
End Date:	03/30/2001
Funding Level:	$ 128,823
Summary:	Develop capability for particle image velocimetry (PIV) diagnostics suitable for investigation of controlled flows.

Title:	Shock-induced Instability of a Thin Fluid Layer/Instabilities in Soap-Film Flows
PIs:	P. Vorobieff
Funding Agency:	Los Alamos National Laboratory
Start Date:	06/05/2000
End Date:	08/18/2000
Funding Level:	$ 24,337
Summary:	Perform advanced-diagnostics experiments on fluid instabilities in two and three dimensions.

Title:	Hysteresis of Vortex-Shedding Behind a Circular Cylinder
PIs:	P. Vorobieff
Funding Agency:	Oak Ridge Associated Univerisites
Start Date:	07/01/2000
End Date:	07/01/2001
Funding Level:	$ 10,000 (50% cost-sharing)
Summary:	Investigate the recent claims of hysteretic behavior near the onset of Bénard - von Kármán instability.

Title:	Shock-Driven Transition to Turbulence as a Code Validation Problem
PIs:	P. Vorobieff
Funding Agency:	Sandia National Laboratories
Start Date:	10/01/2000
End Date:	09/30/2001
Funding Level:	$ 35,000
Summary:	Develop analysis methods for quantitative validation of numerical prediction of transition to turbulence. Provide a sample set of experimental benchmarks.

Title:	Experimental Flow Diagnostics and Numerical Prediction of Mixing in Chemical Lasers
PIs:	P. Vorobieff (PI), C.R. Truman (co-PI)
Funding Agency:	DARPA
Start Date:	04/01/2001
End Date:	08/31/2003
Funding Level:	$ 300,000
Summary:	Develop an experimental system for quantitative diagnostics of flow inside a chemical laser. Examine the influence of flow hydrodynamics on laser performance. Perform numerical simulations.

Title:	Experimental Study of Wake and Cavity Flows
PIs:	P. Vorobieff, C.R. Truman (subaward; program PIs: L. Crossey, D. Kauffman, program director: N. Vadiee)
Funding Agency:	NASA PURSUE
Start Date:	01/01/2001
End Date:	12/21/2001
Funding Level:	$ 25,630
Summary:	Use advanced diagnostics for 2D hydrodynamics studies. Involve undergraduate students in research.

Title:	Fluid Mechanics Studies for Aerodynamic Flow Control
PIs:	C.R. Truman, P. Vorobieff (subaward; program PIs: L. Crossey, D. Kauffman, program director: N. Vadiee)
Funding Agency:	NASA PURSUE
Start Date:	06/01/2000
End Date:	12/21/2001
Funding Level:	$ 32,750
Summary:	Develop diagnostics for wind-tunnel studies of controlled flow. Involve undergraduate students in research.

Title:	Flow Diagnostic System Development
PIs:	C.R. Truman (PI), P. Vorobieff (co-PI)
Funding Agency:	Boeing
Start Date:	03/01/2002
End Date:	09/30/2002
Funding level:	$ 97,340
Summary:	Instrumentation for a high-speed laser induced fluorescence system.

Title:	Experimental Analysis in Support of Physics-Based Validation
PI:	P. Vorobieff
Funding Agency:	Los Alamos National Laboratory
Start Date:	04/22/2003
End Date:	04/30/2005
Funding level:	$ 150,000
Summary:	Perform experiments and analysis of experimental data to provide quantitative benchmarks for development of numerical codes predicting transition to turbulence.

Title:	Bifurcations in a wedge flow
PI:	V. Putkaradze (PI), P. Vorobieff (co-PI)
Funding Agency:	Petroleum Research Foundation
Start Date:	06/01/2003
End Date:	05/31/2004
Funding level:	$ 120,000
Summary:	Study of fundamental instabilities and bifurcations in wedge flows.

Title:	Experimental and Numerical Investigation of Flows in Expanding Channels
PI:	V. Putkaradze (PI), P. Vorobieff (co-PI)
Funding Agency:	US DOE
Start Date:	02/01/2004
End Date:	01/31/2007
Funding level:	$ 495,000
Summary:	Study of fundamental instabilities and bifurcations in wedge flows.

Title:	Experimental and numerical studies of superhydrophobic surfaces
PI:	A.A. Mammoli (PI), P. Vorobieff (co-PI)
Funding Agency:	Sandia National Laboratories
Start Date:	05/01/2004
End Date:	08/30/2005
Funding level:	$ 50,000
Summary:	Investigation of the possibility of macroscopic fluid slip on superhydrophobic surfaces.

Title:	Localized scale coupling and new educational paradigms in multiscale mathematics and science
PIs:	M.S. Ingber (PI), P. Vorobieff (co-PI)
Funding Agency:	US DOE
Start Date:	10/01/2005
End Date:	09/30/2008
Funding level:	$ 345,000
Summary:	Experimental and numerical study of irreversibility in multiphase flows.

Title:	Experimental and numerical studies of superhydrophobic surfaces
PI:	A.A. Mammoli (PI), P. Vorobieff (co-PI)
Funding Agency:	Sandia National Laboratories
Start Date:	10/01/2005
End Date:	09/30/2006
Funding level:	$ 50,000
Summary:	Investigation of macroscopic fluid slip on textured superhydrophobic substrates.

Title:	UNM Solar Power Testbed
PI:	A.A. Mammoli (PI), P. Vorobieff (co-PI)
Funding Agency:	State of New Mexico ENMRD
Start Date:	11/01/2005
End Date:	10/31/2006
Funding level:	$ 225,000
Summary:	Construction and testing of a solar thermal system.

Title:	PLIF diagnostics of iodine injection
PI:	C.R. Truman (PI), P. Vorobieff (co-PI)
Funding Agency:	DOD SBIR Phase I
Start Date:	03/01/2006
End Date:	09/01/2006
Funding level:	$ 30,000
Summary:	Analysis of mixing in chemical laser.

Title:	Analysis of PLIF images in iodine injection studies
PI:	P. Vorobieff (PI), C.R. Truman (co-PI)
Funding Agency:	DOD SBIR Phase II
Start Date:	01/01/2007
End Date:	12/31/2008
Funding level:	$ 30,000
Summary:	Analysis of mixing enhancement in chemical laser.

Title:	Studies of High-Speed Mixing Flows with Particulates
PI:	F. Gilfeather (UNM lead PI), P. Vorobieff (PI), C.R. Truman (co-PI)
Funding Agency:	DTRA
Start Date:	08/01/2007
End Date:	07/31/2008
Funding level:	$ 401,000
Summary:	Construction of a tiltable shock tube, experiments with shock-driven multiphase flows.