

## RESUME of James F. Driscoll (2015)

Title: A.B. Modine Professor of Aerospace Engineering, University of Michigan

Education: Ph.D. (Aerospace and Mechanical Sciences), Princeton University, 1975  
M.S. (Aerospace and Mechanical Sciences), Princeton University, 1973  
B.S. (Engineering Physics), Cornell University, 1970

### Previous positions:

Interim Chair, Dept. of Aerospace Engr., Univ. of Michigan, 9/03 to 1/05  
Visiting Scientist, Aero Propulsion Lab, Wright-Patt. AFB, 1992  
Adjunct Professor, Ecole Centrale de Paris, 1992  
Visiting Scientist, Sandia National Lab, Livermore, CA, 1981.  
Visiting Research Fellow, USAF Rocket Propulsion Lab., Edwards, CA, 1977  
Guggenheim Fellow, Princeton University, 1970-1974.

### National service and awards

1. Elected Vice President/President-Elect of The Combustion Institute, 2012. He becomes President in 2016 of the single organization that oversees the two major combustion journals and individual sections in 32 countries with 6,000 members.
2. Editor, *Combustion and Flame*, 1/1/03 to 1/1/09.
3. Technical Program Co-Chair, 28th Symp. on Combustion, Edinburgh, 2000.
4. Board of Directors of the Combustion Institute, 2002-present.
5. Arthur B. Modine Endowed Chair, College of Engineering, U. of Michigan,
6. Elected Fellow of AIAA, American Inst. of Aeronautics & Astronautics, 2005.
7. AIAA Propellants and Combustion career award, 2013.
8. Silver Medal of the Combustion Institute, 1998.
9. One of the Ten Most Cited Articles in *Combustion and Flame* 2005-2008,
10. Distinguished Paper Award, 31<sup>st</sup> Int. Symp. on Combustion, Heidelberg 2006.
11. AIAA Best Paper Award in Propellants and Combustion in 2008 and 1993.

### Research contributions

J. F. Driscoll has applied modern kilohertz laser imaging diagnostics to better understand the physics of turbulent combustion. He developed a flame-vortex experiment to show that the flame-vortex interaction is a fundamental building block of turbulent combustion, for which he was awarded the Silver Medal by the Combustion Institute. He developed a way to measure the rate of stretch of the wrinkled surface of a turbulent flame, called the method called simultaneous PIV-PLIF diagnostics. In 2001, Dr. Driscoll applied kilohertz high speed PIV imaging diagnostics to combustion, which previously had only been used in non-reacting flows. Later, his work showed how turbulent eddies interact with, wrinkle and stretch a flame. They used their data to develop a subgrid model of premixed turbulent flames. His experiments have been modeled by the CFD groups at Lawrence Berkeley Lab and U. of Cambridge.

Dr. Driscoll recently has measured the boundaries of the Borghi regime diagram, to determine where thickened flamelets, broken flamelets and distributed reactions occur.

To do so, simultaneous images of formaldehyde, OH and CH were recorded. Such images of reaction zones also were recorded within a scramjet - ramjet combustor; they showed how auto-ignition reactions interact with conventional chemical reaction processes. Dr. Driscoll also has published a series of journal papers on the fundamental blowout limits of flames in high-speed air flows, such as those found in scramjets.

### **Recent Archival Journal articles**

1. Bell, J.B., Day, M.S., Grcar, J.F., Lijewski, M.J., Driscoll, J.F., Filatyev, S., "Numerical Simulation of a Turbulent Flame", Proc. Comb. Inst. 31, 2006.
2. Sutton, J.A. and Driscoll, J.F., "Imaging of Local Flame Extinction Due to the Interaction of Scalar Dissipation Layers", Proc. Combust. Inst. 31, 2006.
3. Rasmussen, C.C., Dhanuka, S., and Driscoll, J.F., "Visualization of Flameholding Mechanisms in a Supersonic Combustor", Proc. Comb. Inst. 31, 2505-2512, 2007.
4. Driscoll, J.F., "Turbulent Premixed Combustion: Flamelet Structure and its Effect on Turbulent Burning Velocities", Prog. In Energy & Comb. Sci., 34, 1, p. 91-134, 2008.
5. Schumaker, S.A. and Driscoll, J.F., "Coaxial Turbulent Jet Flames: Scaling Relations for Measured Stoichiometric Mixing Lengths", Proc. Comb. Inst. 32, 1655, 2009.
6. Micka, D.J., and Driscoll, J.F., Combustion Characteristics of a Dual-Mode Scramjet Combustor with Cavity Flameholder, Proc. Combustion Inst. 32, 2397-2404, 2009.
7. Dhanuka, S.K., Temme, J.E., Driscoll, J.F., Mongia, H.K., Vortex Shedding Effects on Periodic Flashback in a Lean Premixed Pre vaporized Gas Turbine Combustor, Proc. Combustion Inst. 32, 2901, 2908, 2009.
8. Steinberg, A.M., Driscoll, J.F., Ceccio, S.L., Temporal Evolution of Flame Stretch due to Turbulence, Proc. Combustion Inst. 32, 1713-1721, 2009.
9. Steinberg, A.M., Driscoll, J.F., Ceccio, S.L., Measurements of turbulent premixed flame dynamics using cinema stereoscopic PIV, Expts. in Fluids 44, 6, 985, 2008.
10. Steinberg, A.M., Driscoll, J.F., Three-dimensional temporally resolved measurements of turbulence-flame interactions", Expts. in Fluids (2009) 47:527-547.
11. Steinberg, A.M., Driscoll, J.F., Straining and wrinkling processes during turbulence-premixed flame interaction measured using temporally-resolved diagnostics, Comb. and Flame 156, 12 (2009) 2285-2306.
12. Steinberg, A.M., Driscoll, J.F., Stretch-rate relationships for turbulent premixed combustion LES subgrid models, Combustion and Flame, 157, 7, 1422-1435, 2010.

13. Bian, S. Ceccio, S., Driscoll, J.F., A dual-camera cinematographic PIV measurement system at kilohertz frame rate, Experiments in Fluids, 48, 3, 487-495, 2010.
14. Dalle, D.J, Fotia, M.L., Driscoll, J.F., Reduced-Order Modeling of Two-Dimensional Supersonic Scramjet Inlets, J. of Propulsion and Power, 26,3, 545-555, 2010.
15. Dhanuka, S.K, Temme, J.E., Driscoll, J.F, Unsteady Aspects of Lean Premixed-Prevaporized Gas Turbine Combustors: Flame-Flame and Flame-Shear Layer Interactions, J. Propulsion and Power, 27,3 631-641, 2011.
16. Dhanuka, S.K, Temme, J, Driscoll, J, Lean Limit Combustion Instabilities of a Lean Premixed Prevaporized Gas Turbine Combustor, Proc Comb Inst 33, 2961 2011.
17. Torrez, S.M., Driscoll, J.F., Ihme, M., Fotia, M.L., Reduced Order Modeling of Turbulent Flows With Application to Scramjets, J. of Prop Power, 27, 371, 2011.
18. Micka, D. and Driscoll, J.F., Stratified Jet Flames in a Heated (1364 K) Air Cross-Flow with Autoignition, Combustion and Flame 159, 3, 1205-1214, 2012.
19. Fotia, M.L. and Driscoll, J.F., Isolator-Combustor Interactions in a Direct-Connect Ramjet-Scramjet Experiment, J. Propulsion and Power 28, 1, 83-85, 2012.
20. Bian, S., Driscoll, J.F., Ceccio, S.L., Time resolved flow-field measurements of a turbulent mixing layer over a rectangular cavity, Expts in Fluids, 51, 512011.
21. Steinberg, A.M., Driscoll, J.F., Swaminathan, N., Statistics and dynamics of turbulence-flame alignment in premixed combustion, Comb Flame 159, 8, 2576-, 2012.
22. Schumaker, S.A. and Driscoll, J.F., Mixing Properties of Coaxial Jets with Large Velocity Ratios and Large Inverse Density Ratios, Physics of Fluids 24,5, 055101, 2012.
23. Dalle, D.J., Torrez, S.M. and Driscoll, J.F., Rapid Analysis of Scramjet and Linear Plug Nozzles, J. Propulsion and Power 28, 3, 545-555, 2012.
24. Fotia, M.L., Driscoll, J.F., Ram-Scram Transition and Flame/Shock-Train Interactions in a Model Scramjet Experiment, J. Propulsion and Power, 29, 1, 261-273, 2012.
25. Allison, P.M., Driscoll, J.F., Ihme, M., Acoustic Characterization of a Partially-Premixed Gas Turbine Model Combustor: Syngas and Hydrocarbon Fuel Comparisons, Proc. Combust. Inst. 34, 3145-3153, 2013.

26. Torrez, S.M., Dalle, D.J. and Driscoll, J.F., A New Method for Computing Performance of Choked Reacting Flows and Ram-to-Scram Transition, J. Propulsion and Power 29, 2, 433-445, 2013.
27. Sutton, J.A. and Driscoll, J.F., Measurements and Statistics of Mixture Fraction and Scalar Dissipation Rates in Turbulent Non-premixed Jet Flames, Combustion and Flame 160, 9, 1767-1778, 2013.
28. Temme, J.A., Allison, P.M., Driscoll, J.F., Combustion Instability of a Lean Premixed Prevaporized Gas Turbine Combustor Studied Using Phase-Averaged PIV, Combustion and Flame 161 (2014) 958–970.
29. Dalle, D. J., Torrez, S.M., Driscoll, J.F., Bolender, M.A., Bowcutt, K.G., Minimum-Fuel Ascent of a Hypersonic Vehicle Using Surrogate Optimization, AIAA J. of Aircraft 51, 6 (2014) 1973-1986.
30. Lamorte, N., Friedmann, P.P., Dalle, D. J., Torrez, S.M., Driscoll, J.F., Uncertainty Propagation in Integrated Airframe-Propulsion System Analysis for Hypersonic Vehicles, J. of Propulsion and Power, 31, 1 (2015) 54-68.
31. Allison, P. M., Chen, Y. T., Ihme, M. and James F. Driscoll, Coupling of Flame Geometry and Combustion Instabilities Based on Kilohertz Formaldehyde PLIF Measurements, Proceedings of the Combustion Institute 35, 3, 2014, 3255-3266.
32. Eagle, W. E. and Driscoll, J. F., Shock Wave-Boundary Layer Interactions in Rectangular Inlets: 3-D Separation Topology and Critical Points, Journal of Fluid Mechanics, Vol. 756, pp. 328-353, 2014.
33. Dalle, D.J., Driscoll, J.F., Torrez, S.M., Ascent Trajectories of Hypersonic Aircraft: Operability Limits Due to Engine Unstart, Journal of Aircraft: 1-10, 10.2514 /
34. Rosenberg, D. A., Allison, P.M., Driscoll, J. F., Flame Index and its Statistical Properties Measured to Understand Partially-Premixed Turbulent Combustion, Combustion and Flame, 62, 7, 2015, 2808-2822.