

01-3 IUTAM Symposium on Turbulent Mixing and Combustion Kingston, Ontario Canada, June 3-6, 2001

a) Scientific Committee

A. Pollard (Canada, Co-Chair), S. Candel (France, Co-Chair), J. Ferziger (USA), J.C.R. Hunt (England), N. Peters (USA),
S. Pope (USA), A.E. Perry (Australia, deceased),
A.V. Johansson (Sweden), T. Takeno (Japan), T. Tatsumi (Japan, IUTAM repres.).

b) Short summary of scientific progress achieved

The goals of the Symposium were to draw together researchers in turbulence and combustion so as to highlight advances and challenge the boundaries to our understanding of turbulent mixing and combustion from both experimental and simulation perspectives; to facilitate cross-fertilization between leaders in these two fields. These goals were noted to be important given that turbulence itself is viewed as the last great problem in classical physics and the addition of chemical reaction amplifies the difficulties enormously.

The quality of the papers, the organisation and the salubrious atmosphere of Kingston and Queen's University uniformly impressed the participants. The Symposium was divided into six sessions, each begun with a Keynote lecture. Each session had a theme, from turbulent mixing with no chemical reaction through to turbulent mixing dominated by chemistry. Oral presentations of 20-minutes each followed by brief 5-minute presentations from poster authors followed each Keynote. The final volume will contain reviewed contributions from all sectors (Keynote, oral and poster). The consensus was this Symposium was so dramatically important to our science that a future meeting should be pursued. This symposium, which could be held in 2005 in France, would focus on the dynamics of turbulent mixing and combustion and emphasize large eddy simulations, coupled problems and flow control problems. A proposal will be submitted to IUTAM in 2002.

The Symposium comprised two receptions, one in Ban Righ Hall and the other at the Kingston Museum of the Great Lakes. Lunches were held in the local yacht club, in the Queen's University Agnes Etherington Art Gallery and the stately Wallace Hall. The Symposium banquet was held in the atmosphere of 1812 within the mess of Kingston's historic Fort Henry. A final wrap up party was held in the University Club.

c) Countries represented and number of participants

Japan (6), France (23), Canada (23), USA (23), Germany (1), Netherlands (1), Italy (2), Norway (1), Russia (1), United Kingdom (2), Sweden (1)

d) Publication of Proceedings of the Symposium

The proceedings will be published by Kluwer Academic Publishers in 2002 (editors: A. Pollard and S. Candel)

e) Financial support

Financial support for the Symposium was generously provided by:

- International Union of Theoretical and Applied Mechanics
- The National Research Council of Canada
- Natural Resources Canada
- CANMET Energy Technology Centre
- Queen's University at Kingston
- The Centre for Advanced Gas Combustion Technology
- Queen's University and the Canadian Gas Association.

f) Scientific program

Opening and Welcome:

A. Pollard (co-Chair), S. Candel (co-Chair), B. Hutchinson, T. Harris, T. Tatsumi (IUTAM repres.)

Session 1:

Keynote Lecture

E. Villermaux, *Mixing as an Aggregation Process.*

Oral presentations

Jung, Gamard, Woodward, George, *Further investigation of the jet mixing layer using a 138 hot-wire probe and the POD.*

Brethouwer and Nieuwstadt, *On the behaviour and the characteristics of scalar gradients in isotropic turbulence.*

Blossey, Narayanan, Bewley, *Dynamics and control of a jet in a cross-flow: direct numerical simulations and experiments.*

Mesnier, Blanchard, Sarn and Gokalp, *PIV measurements of the near field of a variable density turbulent jets: a comparison between a circular jet and a rectangular jet.*

Okong'o and Bellan, *Characteristics of supercritical transitional mixing layers.*

Posters presentations

Ewing and Woodward, *On accurate experimental measurements of the dynamics of large scale structures in turbulent flows.*

Sigurdson and Diep, *Mixing in a cross-jet enhanced by a coaxial annular synthetic jet.*

Marrot, Biscos, Gajan and Pauzin, *Pulse injection of droplets in vortical structures.*

Zapryagaev, Kisilev and Solotchin, *Experimental investigation of the streamwise vortices in the mixing layer of the supersonic underexpanded jet.*

Session 2:

Keynote Lecture

P. Dimotakis, *Challenges in Turbulent Mixing with Combustion*.

Oral presentations

Hewson, Echekki and Kerstein, *One-dimensional stochastic simulation of advection-diffusion-reaction couplings in turbulent combustion*.

Livescu and Madnia, *Compressibility effects on the scalar mixing in reacting homogeneous turbulence*.

Crecco, Vezzani, Giammartini and Romano, *Experiments on the velocity and concentration fields at the outlet of a Bunsen without and with combustion*.

Sarkar and Pantano, *The interaction of scalar mixing and reaction rate in a reacting shear layer*.

Gicquel, Hilbert, Thevenin and Darabiha, *Influence of differential diffusion on local equilibrium and super-adiabatic combustion in turbulent non-premixed flames*.

Poster presentations

Boulanger and Vervisch, *Effect of transverse heat fluxes in diffusion flame quenching*.
Helie and Trouve (Best Poster Award), *A model description of the effects of variable fuel-air mixture composition on turbulent flame propagation*.

Zhou, Zimmerman and Burke, *Formulation of a two scale transport scheme for turbulent mixing induced by Rayleigh-Taylor and Richtmyer-Meshkov instabilities*.

Session 3

Keynote Lecture

C. Meneveau, *Challenges in modeling scalars in turbulence and LES: anisotropy, dynamic models and scale separation*.

Oral presentations

Ferchicki and Tavoularis, *PDF of Temperature fluctuations in uniformly sheared turbulence*.

Moreau, Elmo, Bertoglio, *A priori tests of subgrid models for the scalar fluctuation in statistically stationary isotropic turbulence*.

Lardjane, Fedious, Gokalp, *Evaluation of sub-grid scale magnitude in LES of large density ratio mixing layers*.

Bourlioux, Majda, *A mathematical prototype to validate LES strategies for turbulent flames*.

Szasz, Caraeni and Fuchs, *Effects of differential diffusion in turbulent jet flows*.

Poster presentations

Knikker and Veynante, *A sub-grid scale flame surface density similarity model for large eddy simulations of turbulent premixed combustion*.

Sapede, Harion, Caillat and Baudoin, *Coaxial rectangular jet with density differences – numerical simulations versus experimental data*.

Benaissa, Amiehl, Anselmet and Lemay, *Local interaction between dynamic and scalar structures in variable density turbulent jets*.

Session 4:

Keynote Lecture

L. Vervisch, *LES of partially premixed combustion.*

Oral presentations

Hilbert, Thevenin, *Turbulent non-premixed flames investigated using direct numerical simulations with detailed chemistry.*

Givi, Gicquel, Jaber, Pope, *PDF methods for large eddy simulation of turbulence reactive flows.*

Tullis, Cant, *Scalar transport effects in large eddy simulation of premixed turbulent flames.*

Tanahashi, Ito, Fujimora, Miyauchi, *Local flame structure in hydrogen-air turbulent premixed flames.*

Thevenin, Hilbert, Gicquel, *Three dimensional direct simulations of turbulent flames using realistic chemistry modeling.*

Poster presentations

De Charentenay, Thevenin and Zamuner, *Simulation of buoyancy driven diffusion flame.*

Tanq and Pope, *Accurate and efficient implementation of combustion chemistry using in-situ adaptive tabulation with dimension reduction.*

Johnson and Kostiuk (Best Poster Award), *Imaging of the fuel stripping mechanism for wake stabilized diffusion flames in a cross flow.*

Session 5

Keynote Lecture

P. Moin, *Progress in control of mixing and LES of combustion.*

Oral presentations

Legier, Varoquie, Lacas, Poinot, Veynante, *Large eddy simulation of a non-premixed turbulent burner using a dynamically thickened flame model.*

Guilini, Gajan, Diers, Biscos, *Characterisation of an air-blast injection device with forced periodic entries.*

Mizobuchi, Takaki, Tachibana, Ogawa, *Numerical analysis of hydrogen-air jet diffusion flame.*

Ben Dakhli, Charentenay and Giovangigli, *Turbulent mixing with sprays.*

Poster presentations

Ducruix, Poinot and Candel, *Large eddy simulations of combustion instabilities in a swirled combustor.*

Weydahl, Gran and Ertesvag, *Prediction of nitric oxide formation in ammonia doped turbulent syngas jet flames*

Choi, Kastumoto, Nakabe and Suzuki, *An experimental investigation of mixing and combustion characteristics on the can-type micro-combustor with a multi-jet baffle plate.*

Pollard and McIlwain, *Effects of single, dual and quadruple tabs on the near field of round jets.*

Session 6

Keynote Lecture

J. Janicka, *Turbulent mixing and combustion: Perspectives.*

Oral presentations

Poinsot, *Using large eddy simulations to understand combustion instabilities in gas turbines.*

Lentini, *Improved modeling of the N₂O pathway contribution to NO_x in non-premixed turbulent flames.*

Sankaran, Menon, *Subgrid combustion modeling of two-phase reacting flows.*

Jimenez, Cuenot, Poinsot, Haworth, Blint, *Numerical simulation of propane-air combustion in stratified premixed conditions.*

Poster presentations

Tchernyshyev, Kharitonov and Lokotko, *Intensification of mixing processes in supersonic flows in a model of a rocket scramjet engine.*

Juniper, Tripathi, Scouflaire, Rolon and Candel, *Turbulent combustion of sprays under super-critical conditions.*

Suk, Sullivan and Fetter, *Experimental investigation of reciprocating flow in a water engine.*

Vereschagin, *CARS diagnostics of turbulent mixing and combustion.*

Report composed by A. Pollard and S. Candel