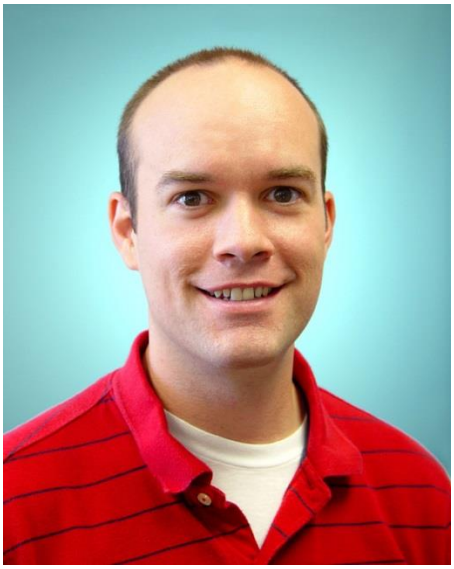
SAND2013-9715P

CRF Visitors – July 2013

Russell Fitzgerald
6/3/13-7/26/13
Host: Isaac Ekoto

General Electric (GE) research scientist and former Sandian Russell Fitzgerald came to the CRF for two months to work with Isaac Ekoto to evaluate the suitability of employing an in situ carbon monoxide (CO) detection technique in an optically accessible gas turbine test rig located at GE Global Research in New York. GE's goal is to use this technique within their rig to better understand and ultimately reduce CO emissions at gas turbine electricity generation plants during low-load operation. Russell and Isaac acquired measurements via CO laser induced fluorescence under well controlled conditions and will use these data to validate a fluorescence signal model originally developed by Paul Miles that applies corrections for temperature, pressure, and mixture composition. They also examined irradiance threshold limits for different grades of quartz to understand the impact of the deep ultraviolet laser excitation on the glass casing in the GE test rig. Finally, they evaluated the potential of formaldehyde as a CO surrogate, which is diagnostically easier to detect. Future plans for this collaboration, first envisioned in a Sandia/GE working group meeting, call for implementing the diagnostics in the GE test rig sometime in 2014.



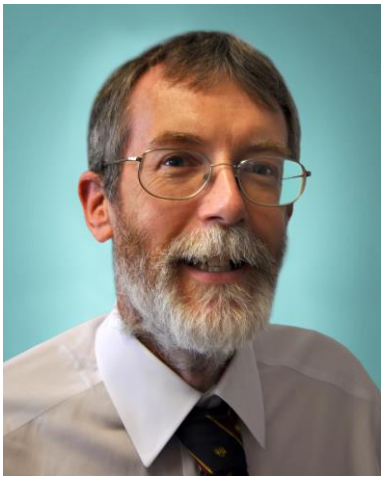
CRF Visitors- August 2013

Chris Lietz
7/8/2013-8/16/2013
Host: Jackie Chen

Chris Lietz, a PhD student from the University of Texas at Austin, visited Jackie Chen, Ankit Bhagatwala, and Hemanth Kolla for a month this summer. Chris's work at the CRF is part of a longer-term collaboration with his advisor, Professor Venkat Raman, in two areas: a posteriori LES/flamelet modeling of premixed flame boundary layer flashback in a turbulent channel flow and the development of a novel DNS/LES modeling framework to assess LES mixing and combustion models at different filter scales.

Stewart Cant
8/12/2013-8/30/2013
Host: Jackie Chen

Professor Stewart Cant from Cambridge University spent a month collaborating with Jackie Chen, Sgouria Lyra, and Hemanth Kolla on fundamental topics related to the structure of turbulent premixed flames in intense sheared turbulence. With his Ph.D. student Ryan Griffiths and in collaboration with Professor Wolfgang Kollmann from University of California, Davis, Professor Cant and the CRF team analyzed and classified the topology of turbulent premixed flames and several kinematic quantities. In particular, they concentrated on a classification for the topology of the reaction progress variable and its dissipation rate, along with the enstrophy and strain rate fields. Professor Cant will continue this collaboration from Cambridge, extending the range of topics to include modeling of premixed flames, specifically, turbulent flame-wall boundary layer interactions and spectral energy transfer in turbulent premixed flames.



Dirk Geyer
7/22/2013-8/23/2013
Host: Rob Barlow

Dirk Geyer, a professor at the Technical College in Darmstadt, Germany, who also has a research affiliation with the Technical University of Darmstadt, spent several weeks working with CRF researchers to extend Raman scattering techniques for measurements in a variety of turbulent hydrocarbon flames. Over the summer, the team focused on Raman spectroscopy of stable hydrocarbon intermediates that appear in flames of dimethyl ether (DME) and the development of detection hardware for polarization separation Raman scattering. This work is part of a long-term collaboration between Sandia and the combustion group in Darmstadt to develop improved detection hardware and methods of analysis of spontaneous Raman scattering measurements in flames.

Justin Kwok
6/17/2013-8/16/2013
Host: Lenny Sheps

During his 10 weeks as an undergraduate summer intern, Justin Kwok worked with Leonid Sheps and Judit Zádor on an experimental project that investigates fundamental chemical kinetics relevant to combustion—work that aligns with Justin's chemical engineering major at the University of Southern California. While at the CRF, he used laser-induced fluorescence (a very sensitive optical detection method) to monitor the reactions of hydroxyl radicals with trans-2-butene over broad ranges of temperature (300–800 K) and pressure (1–20 atm). The experimental data that Justin collected will help validate the chemical mechanism for the reaction of OH + butene, which has broader implications for the combustion models of other unsaturated hydrocarbons and alcohols.

September visitors

Niels Leermakers
5/1/2013-9/13/2013
Host: Mark Musculus

Niels Leermakers, a Ph.D. candidate from Eindhoven University of Technology in The Netherlands, visited the CRF for four months to collaborate with Mark Musculus on a DOE project to better understand details of the temporal and spatial evolution of soot and soot precursors under low-temperature combustion (LTC) conditions. Working in the heavy-duty optical diesel engine laboratory, Niels developed and implemented a multiple laser–based optical diagnostic technique to gain new insight into the early stages of soot formation. Niels' work successfully achieved the DOE goals, showing that under LTC conditions, soot precursor formation is more broadly distributed in both space and time than for conventional diesel combustion. This work also complemented Niels' dissertation efforts at Eindhoven, where Niels works in the combustion engines group of Professors Bengt Johansson and Philip de Goey.

Antony Misdariis
6/16/2013-9/13/2013
Host: Joe Oefelein

Antony Misdariis, a visitor from CERFACS, a French research organization that develops advanced methods for numerical simulation of complex problems, performed collaborative research in large eddy simulation of turbulent combustion at high-pressure conditions. This work aided in the development of models that simulate the injection of liquid fuels into combustion devices at thermodynamically supercritical conditions. Because high-pressure combustion phenomena are important to all transportation, propulsion, and power systems, new predictive models of such phenomena are critical to designing these systems.

Brian McDonald
6/17/2013-9/20/2013
Host: Robert Barlow and Bob Harmon

Brian McDonald, who is working on an MS degree in Mechanical Engineering at Stanford University, made significant contributions on several fronts during his summer internship at the Turbulent Combustion Laboratory. Specifically, he performed LabView programming for a new data acquisition platform and did extensive tests on flow calibration accuracy. He also helped setup and debug a newly expanded Raman/Rayleigh/LIF detection system and assisted with preparations for a visiting turbulent jet flame experiment from the University of Sydney.

Magne Haveraaen
7/15/13-8/8/2013
Host: Karla Morris

During several weeks at the CRF, Magne Haveraaen collaborated on developing software for a solver application using coarrays, a new feature of Fortran 2008 that provides the programming language with parallel programming supports. The new software—which demonstrates the use of domain-specific, object-oriented software design patterns to ease the evolution of partial differential equation (PDE) solver software based on vector and tensor calculus expressions—helps advance research on platform-agnostic high performance computing. Magne is the head of Bergen Language Design Laboratory (BLDL) at the University of Bergen and is one of the developers of the Magnolia programming language, which is motivated by coordinate-free numerics and high performance support.

Avinash Gadok
7/12/2013-8/16/2013
Host: Carl Hayden

Avinash Gadok, a bioengineering graduate student from University of Texas (UT), Austin, visited our labs for one month over the summer. During her stay, Avi used minimal sets of proteins on artificial lipid membranes to reconstruct the protein assemblies that cells use to encapsulate cargoes during the cellular endocytosis process. The membrane curvature produced by these protein assemblies was measured using total internal reflection microscopy. These studies are designed to determine the mechanism for membrane vesicle formation in clathrin-mediated endocytosis, a critical process in synaptic transmission and cellular protein trafficking. Imperfections in the molecular scale functioning of endocytosis contribute to a range of serious health problems. Avi has returned to UT, where she studies with our collaborator, Professor Jeanne Stachowiak.

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