

# CHRISTOPHER J. AUL

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- EDUCATION**
- TEXAS A&M UNIVERSITY** College Station, TX  
**Ph.D. in Mechanical Engineering** May 2013  
Advisor: Dr. Eric L. Petersen  
Thesis: “*Measuring Hydroxyl Radicals During the Oxidation of Methane, Ethane, Ethylene, and Acetylene in a Shock Tube Using UV Absorption Spectroscopy*”
- TEXAS A&M UNIVERSITY** College Station, TX  
**Master of Science in Mechanical Engineering** December 2009  
Advisor: Dr. Eric L. Petersen  
Thesis: “*An Experimental Study into the Ignition of Methane and Ethane Blends in a New Shock-Tube Facility*”
- UNIVERSITY OF CENTRAL FLORIDA** Orlando, FL  
**Bachelor of Science in Mechanical Engineering** December 2006  
Energy Systems Track
- EXPERIENCE**
- STEPHEN F. AUSTIN STATE UNIVERSITY** Nacogdoches, TX  
Assistant Professor, Engineering Physics June 2015 – Present
- Taught courses in mechanics of materials, fluid mechanics, engineering design and computations
  - Initiated laboratory to investigate high-temperature physics and combustion phenomena
  - Formed framework for ABET accreditation of new Engineering Physics degree offering
- SCHLUMBERGER** Houston, TX  
Mechanical Engineer, New Product Development June 2013 – June 2015
- Designed new high-pressure/high-temperature formation isolation valves (FIV)
  - Ran FEA on FIVs used in the harshest of well environments for the HP-FORTRESS series of valves
  - Conducted actuation and qualification testing on FIV prototypes at SLB testing centers
- TEXAS A&M UNIVERSITY** College Station, TX  
Graduate Research Assistant January 2008 – June 2013
- Implemented a design of experiments method for testing CH<sub>4</sub>/C<sub>2</sub>H<sub>6</sub> mixtures at varying conditions
  - Investigated ignition behavior of sample fuel and air samples from local gas turbine facilities
  - Developed method for calibrating infrared absorption spectroscopy diagnostic for H<sub>2</sub>O<sub>2</sub>
  - Installed laser absorption diagnostic to measure water concentration on several experiments
  - Set up a monochromator-based absorption spectroscopy diagnostic for measuring OH in a shock tube
- ARGONNE NATIONAL LABORATORY** Lemont, IL  
Visiting Researcher, Funded February 2011
- Conducted laser schlieren densitometry experiments on C<sub>3</sub>H<sub>3</sub>I within a diaphragmless shock tube
  - Performed shock tube experiments coupled with Time-of-Flight Mass Spectrometry (TOF-MS)
- THE AEROSPACE CORPORATION** El Segundo, CA  
Staff Scientist Assistant, Casual, *US SECRET Clearance (DoD)* May 2010 – January 2012
- Collaborated research efforts between Texas A&M and The Aerospace Corporation
  - Performed high-pressure shock tube experiments on RP-1, JP-8, and other aerospace fuels
  - Investigated shock interactions and blast waves using a Z-type schlieren technique
  - Developed methods for measuring multiple species using laser absorption spectroscopy

**TECHNICAL UNIVERSITY OF MUNICH**

Visiting Researcher, Lehrstuhl für Thermodynamik, NSF Funded

Munich, Germany

May 2009 – July 2009

- Conducted OH\*, CH\*, and CO<sub>2</sub>\* chemiluminescence experiments with PIV on turbulent flames
- Researched PIV and chemiluminescence data to determine heat release within swirled flames

**UNIVERSITY OF CENTRAL FLORIDA**

Undergraduate &amp; Graduate Research Assistant

Orlando, FL

September 2006 – December 2007

- Supervised the design and installation of a high-pressure (100 atm) shock-tube facility
- Researched combustion chemistry and ignition characteristics of hydrocarbon fuels
- Performed experiments on various natural gas blends to validate chemical kinetics model

**MILAN ENGINEERING**

Intern Mechanical Engineer Designer / Drafter

Orlando, FL

October 2005 – November 2006

- Design and implementation of work in HVAC, Electrical, and Plumbing systems
- Developed proficiency with AutoCAD software in implementing MEP systems
- Personal study and experience with state-recognized Professional Engineers

**TEACHING****Stephen F. Austin State University:**

Courses taught:

- Engineering Statics, Fall 2016, Fall 2017, Fall 2018
- Engineering Capstone Design, Spring 2016, Fall 2016, Spring 2018, Spring 2019
- Engineering Seminar, Spring 2016
- Fluid Mechanics, Spring 2016, Spring 2017, Spring 2018, Spring 2019
- Foundations of Engineering I, Fall 2015, Fall 2016, Fall 2019
- Foundations of Engineering II, Spring 2016, Spring 2017
- Geometric Modeling for Mechanical Design, Fall: 2017, 2018, 2019, Spring: 2018, 2019
- Mechanics of Materials, Fall 2015, Fall 2016, Fall 2017, Fall 2018, Fall 2019

**Texas A&M University:**

Teaching Assistant:

- Gas Dynamics, Fall 2011

Guest Lecturer:

- Fluid Mechanics, Spring 2012 and Fall 2012
- Gas Dynamics, Fall 2011
- Combustion Science and Engineering, Fall 2011 (Graduate Level)

**HONORS**

Distinguished Grant Award, Stephen F. Austin State University, April 2017

United States SECRET security clearance, August 2011 (through Aerospace Corporation)

Travel award for the 7<sup>th</sup> US National Combustion Meeting at Georgia Institute of Technology, 2011NSF award for travel to the 33<sup>rd</sup> International Symposium on Combustion in Beijing, China, 2010

Travel and stipend award for CEFRC Summer Course in Combustion at Princeton University, 2010

Best Technical Paper Award, IGTI, ASME Turbo Expo 2008, ASME Paper GT2008-51344

**SOCIETIES**

American Society of Mechanical Engineers

American Society of Engineering Education

American Institute of Aeronautics and Astronautics

## PUBLICATIONS AND CONFERENCE PROCEEDINGS

### Journal Publications

- 1) N. Donohoe, K. A. Heufer, **C. J. Aul**, E. L. Petersen, G. Bourque, R. Gordon, H. J. Curran, "Influence of Steam Dilution on the Ignition of Hydrogen, Syngas and Natural Gas Blends at Elevated Pressures," *Combustion and Flame*, Vol. 162, 2015, pp. 1126-1135
- 2) P. T. Lynch, C. J. Annesley, **C. J. Aul**, X. Yang, R. S. Tranter, "High Temperature C<sub>3</sub>H<sub>5</sub> Recombination in Fall-off," *Journal of Physical Chemistry A*, Vol. 117 (23), 2013, pp. 4750-61
- 3) **C. J. Aul**, W. K. Metcalfe, H. J. Curran, E. L. Petersen, "Ignition and Kinetic Modeling of Methane and Ethane Fuel Blends with Oxygen: A Design of Experiments Approach," *Combustion and Flame*, Vol. 160 (7), 2013, pp. 1153-67
- 4) M. Lauer, M. Zellhuber, T. Sattelmayer, **C. J. Aul**, "Determination of the Heat Release Distribution in Turbulent Flames by a Model Based Correction of OH\* Chemiluminescence," *Journal of Engineering for Gas Turbines and Power*, Vol. 133, 2011, pp. 121501-12
- 5) **C. J. Aul**, M. W. Crofton, J. D. Mertens, E. L. Petersen, "A Diagnostic for Measuring H<sub>2</sub>O<sub>2</sub> Concentration in a Shock Tube using Tunable Laser Absorption near 7.8  $\mu$ m," *Proceedings of the Combustion Institute*, Vol. 33, 2010, pp. 709-716.
- 6) D. Healy, H. J. Curran, N. S. Donato, **C. J. Aul**, E. L. Petersen, C. M. Zinner, G. Bourque, "n-Butane: Ignition Delay Measurements at High Pressure and Detailed Chemical Kinetic Simulations," *Combustion and Flame*, Vol. 157, 2010, pp. 1526-1539.
- 7) D. Healy, H. J. Curran, N. S. Donato, **C. J. Aul**, E. L. Petersen, C. M. Zinner, G. Bourque, "Isobutane Ignition Delay Time Measurements at High Pressure and Detailed Chemical Kinetic Simulations," *Combustion and Flame*, Vol. 157, 2010, pp. 1540-1551.
- 8) D. Healy, H. J. Curran, D. M. Kalitan, **C. J. Aul**, E. L. Petersen, G. Bourque, "The Oxidation of C1-C5 Alkane Quintary Natural Gas Mixtures at High Pressures," *Energy & Fuels*, Vol. 24, 2010, pp. 1521-1528.
- 9) G. Bourque, D. Healy, H. Curran, C. Zinner, D. Kalitan, J. de Vries, **C. Aul**, E. Petersen, "Ignition and Flame Speed Kinetics of Two Natural Gas Blends with High Levels of Heavier Hydrocarbons," *Journal of Engineering for Gas Turbines and Power*, Vol. 132, 2010, pp. 021504-11.
- 10) N. Donato, **C. Aul**, E. Petersen, C. Zinner, H. Curran, G. Bourque, "Ignition and Oxidation of 50/50 Butane Isomer Blends," *Journal of Engineering for Gas Turbines and Power*, Vol. 132, 2010, pp. 051502-9.
- 11) J. de Vries, **C. Aul**, A. Barrett, D. Lambe, E. Petersen, "Shock-Tube Development for High-Pressure and Low-Temperature Chemical Kinetics Experiments," *Shock Waves*, Part III, 2009, pp. 171-176.

### Conference Proceedings

- 1) E. L. Petersen, J. C. Thomas, T. E. Sammet, **C. J. Aul**, "Undergraduate Research in Energy and Propulsion: Outcomes and Lessons Learned from a 9-Year REU Site," AIAA Propulsion and Energy 2019 Forum, August 19-22, 2019, Indianapolis, IN. AIAA Paper 2019-3893
- 2) H. A. Ochoa, **C. J. Aul**, D. Bruton, C. J. Timmons, "A Summer Camp in Engineering Physics for Incoming Freshmen to Improve Retention and Student Success," 2017 ASEE Annual Conference & Exposition, June 24-28, 2017, Columbus, OH.
- 3) **C. J. Aul**, E. L. Petersen, "Sensing Key Species During Fuel Oxidation in a Shock Tube Using Absorption Spectroscopy," 51<sup>st</sup> AIAA Aerospace Sciences Meeting, January 7-10, 2013, Grapevine, TX. **Presenter**

- 4) **C. J. Aul**, A. Hsu, M. Crofton, E. L. Petersen, "A Shock Tube Study on Petroleum Derived Aerospace Fuels and a Fischer-Tropsch Surrogate," Central States 2012 Spring Meeting, April 22-24, 2012, Dayton, OH. **Presenter**
- 5) **C. J. Aul**, M. W. Crofton, J. D. Mertens, E. L. Petersen, "Measurement of H<sub>2</sub>O<sub>2</sub> Broadening Parameters Near 7.8 μm Using a Shock Tube," for the 28<sup>th</sup> International Symposium on Shock Waves, July 17-22, 2011, Manchester, U.K.
- 6) W. K. Metcalfe, S. M. Burke, **C. J. Aul**, W. Lowry, M. Krejci, M. M. Kopp, N. S. Donato, E. L. Petersen, H. J. Curran, "A Detailed Chemical Kinetic Modeling and Experimental Study of C<sub>1</sub> – C<sub>2</sub> Hydrocarbons," for the 5<sup>th</sup> European Combustion Meeting, June 28-July 1, 2011, Cardiff, Wales, U. K.
- 7) M. Lauer, M. Zellhuber, T. Sattelmayer, **C. J. Aul**, "Determination of the Heat Release Distribution in Turbulent Flames by a Model Based Correction of OH\* Chemiluminescence," for the ASME Turbo Expo 2011, June 6-10, 2011, Vancouver, Canada.
- 8) **C. J. Aul**, M. W. Crofton, J. D. Mertens, E. L. Petersen, "Determination of H<sub>2</sub>O<sub>2</sub> Pressure Broadening near 7.8 μm," for the 7<sup>th</sup> U.S. National Combustion Meeting, March 20-23, 2011, Atlanta, GA. **Presenter**
- 9) **C. J. Aul**, M. W. Crofton, J. D. Mertens, E. L. Petersen, "A Diagnostic for Measuring H<sub>2</sub>O<sub>2</sub> Concentration in a Shock Tube using Tunable Laser Absorption near 7.8 μm," 33<sup>rd</sup> International Symposium on Combustion, August 1-6, 2010, Beijing, China. **Presenter**
- 10) **C. J. Aul**, M. W. Crofton, J. D. Mertens, E. L. Petersen, "Measuring H<sub>2</sub>O<sub>2</sub> Concentration in a Shock Tube using Infrared Tunable Laser Absorption," Proceedings of the 2010 Spring Technical Meeting of the Central States Section of The Combustion Institute, March 21-24, 2010, Urbana, IL. **Presenter**
- 11) **C. J. Aul**, N. Donato, E. L. Petersen, "Shock-Tube Ignition Data and Kinetics Modeling Discrepancies in the Low-Temperature, High-Pressure Regime for Natural Gas Blends," 27<sup>th</sup> International Symposium on Shock Waves, July 19-24, 2009, St. Petersburg, Russia. **Presenter**
- 12) **C. J. Aul**, B. Rotavera, N. Donato, E. L. Petersen, H. Curran, G. Bourque "Oxidation of Normal- and iso-Butane Over a Broad Range of Stoichiometry, Pressure, and Temperature," 27<sup>th</sup> International Symposium on Shock Waves, July 19-24, 2009, St. Petersburg, Russia. **Presenter**
- 13) N. Donato, **C. Aul**, E. Petersen, C. Zinner, D. Healy, H. Curran, G. Bourque, "Ignition and Oxidation of 50/50 n-Butane/iso-Butane Blends," 54<sup>th</sup> ASME Turbo Expo, June 8-12, 2009, Orlando, FL.
- 14) **C. J. Aul**, E. L. Petersen, "Early Ignition Phenomena in Low-Temperature, High-Pressure Shock-Tube Experiments for Non-diluted Alkane Blends in Air," 6<sup>th</sup> U.S. National Combustion Meeting, May 17-20, 2009, Ann Arbor, MI.
- 15) Z. Serinyel, H. J. Curran, C. M. Zinner, **C. J. Aul**, N. S. Donato, E. L. Petersen, "Shock-Tube Ignition Delay Time Measurements and Chemical Kinetics Modeling for Mixtures of Dimethyl Ether and Methane in Air," 4<sup>th</sup> European Combustion Meeting, April 14-17, 2009, Vienna, Austria.
- 16) **C. J. Aul**, E. L. Petersen, B. C. Walker, H. J. Curran, "Ignition of Methane and Ethane Blends with Oxygen at Engine Conditions," AIAA Paper 2008-4768, 44<sup>th</sup> AIAA /ASME /SAE /ASEE Joint Propulsion Conference & Exhibit, July 20-23, 2008, Hartford, CT. **Presenter**
- 17) G. Bourque, D. Healy, H. Curran, C. Zinner, D. Kalitan, J. de Vries, **C. Aul**, E. L. Petersen, "Ignition and Flame Speed Kinetics of Two Natural Gas Blends with High Levels of Heavier Hydrocarbons," ASME Paper GT2008-51344, ASME Turbo Expo 2008, Berlin, Germany, June 9-13, 2008. **Winner – Best Technical Paper Award.**
- 18) **C. J. Aul**, E. L. Petersen, B. C. Walker, H. J. Curran, "Experiments and Kinetics Modeling of Methane-Ethane-Oxygen Mixtures Diluted in Argon," Proceedings of the 2008 Technical Meeting of the Central States Section of the Combustion Institute, April 20-22, 2008, Tuscaloosa, AL. **Presenter**

- 19) **C. J. Aul**, J. de Vries, E. L. Petersen, "New Shock-Tube Facility for Studies in Chemical Kinetics at Engine Conditions," Proceedings of the 2007 Technical Meeting of the Eastern States Section of the Combustion Institute, October 21-24, 2007, Charlottesville, VA. *Presenter*
- 20) J. de Vries, **C. Aul**, A. Barrett, D. Lambe, E. Petersen, "Shock-Tube Development for High-Pressure and Low-Temperature Chemical Kinetics Experiments," Paper No. 0913, 26<sup>th</sup> International Symposium on Shock Waves, July 15-20, 2007, Göttingen, Germany.