

# **Aerodynamic Measurement Technology**

Papers Presented at the AIAA SciTech Forum and Exposition  
2025

Orlando, Florida, USA  
6-10 January 2025

Volume 1 of 2

ISBN: 979-8-3313-1789-8

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwytkug'Xcmg{'Ftkxg.'Uwky'422, Reston, VA 20191, USA.

# TABLE OF CONTENTS

## VOLUME 1

### GAS-PHASE THERMOMETRY

Post-Shock Thermometry Using One-Dimensional fs/ps Coherent Anti-Stokes Raman Scattering .....	1
<i>Ryan J. Thompson, Laurie A. Elkowitz, Chloe E. Dedic</i>	
Two-Color N <sub>2</sub> Resonantly Ionized Photoemission Thermometry for Single-Test Applications .....	10
<i>Aleksander M. Clark, Zhili Zhang, Steven Adams</i>	
Hypersonic Thermal Boundary Layer Profiles via Femtosecond Coherent Anti-Stokes Raman Spectroscopy .....	17
<i>Daniel R. Richardson, Remington S. Ketchum, Sean P. Kearney, Steven J. Beresh</i>	
Measurements of NO Rotational and Vibrational Temperatures, Partial Pressure, and Velocity in Hypersonic Shock Tunnel Flows .....	23
<i>Jonathan J. Gilvey, Christopher S. Goldenstein, Bradley Lyon, Charley Downing, Kyle P. Lynch, Justin L. Wagner</i>	
Characterizing High Repetition Rate One-Dimensional Chirped Probe Pulse Coherent Anti-Stokes Raman Scattering .....	34
<i>Will C. Senior, Benjamin K. Murdock, Kristen M. Stava, Carson D. Slabaugh, Robert P. Lucht</i>	
Dual-Band Wavelength-Modulated Infrared Laser-Induced-Fluorescence Thermometry of CO .....	49
<i>Jonathan O. Rustad, Garrett Mathews, Christopher S. Goldenstein</i>	

### INSTRUMENTATION AND DIAGNOSTIC TECHNIQUES FOR HIGH-SPEED AIR-BREATHING PROPULSION I

Flow-Flame Interactions in a Solid Fuel Ramjet Combustor .....	56
<i>Luca Macarie, Kristen M. Stava, Will C. Senior, Garon Young, Rohan Gejji, Carson D. Slabaugh</i>	
Mid-Infrared Imaging of Supersonic Combustion Exhaust .....	67
<i>Nathan A. Childs, Timothy Ombrello, Mitch Wolff</i>	
Enhancement of Dual-Mode Scramjet Flowpath Control With an Optical Emission Spectroscopy Sensor .....	78
<i>Max Chern, Robert Rockwell, Chloe E. Dedic, Christopher P. Goyne</i>	
Wavelet-Based Optical Flow Velocimetry Using High Repetition-Rate OH-PLIF in Dual-Mode Scramjet .....	95
<i>Owen Petito, Max Chern, Austin M. Webb, Aldo Gargiulo, Christopher P. Goyne, Terrence R. Meyer, Chloe E. Dedic</i>	
Spatially-Resolved In-Situ Characterization of a Supersonic Combustor Using fs/ps CARS .....	107
<i>Andrew J. Metro, Owen Petito, Aldo Gargiulo, Robert Rockwell, Chloe E. Dedic, Andrew D. Cutler</i>	

Coupled Infrared (IR) Thermography and Nitric-Oxide Ionization Induced Flow Tagging and Imaging (NiiFTI) Velocimetry in a Canonical Hypersonic Inlet .....	120
<i>Santiago P. Mercado Barrero, Taylor Best, Farhan Siddiqui, Boris S. Leonov, Richard B. Miles, Simon North, Kevin G. Bowcutt, Rodney Bowersox</i>	

## **INVITED: NASA AMES UNSTEADY PSP DEVELOPMENT FOR TESTING AND EVALUATION**

Invited: uPSP Launch Vehicle Demonstration Test at NASA Ames Research Center.....	132
<i>E. Lara Lash, David D. Murakami, Marc Shaw-Lecerf, Kenneth Lyons, Jie Li, Nicholas Califano, Evan Crowe, Nettie Roozeboom</i>	
Invited: Steady Surface Pressure Measurement via the Lifetime Method With High-Speed Cameras in NASA's Unitary Plan Wind Tunnel.....	143
<i>Kenneth Lyons, David Murakami, Marc Shaw-Lecerf, E. Lara Lash, Nettie Roozeboom, Jie Li, Nicholas Califano</i>	
Invited: Spectral Proper Orthogonal Decomposition of uPSP Measurements in Recent NASA Ames Wind Tunnel Test.....	150
<i>Jie Li, E. Lara Lash, Kenneth R. Lyons, Nettie Roozeboom, Marc Shaw-Lecerf, David Murakami, Nicholas Califano</i>	
Invited: Spatiotemporal Analysis of High-Resolution Pressure-Sensitive Paint Measurements on a Launch Vehicle Wind Tunnel Model .....	172
<i>Marc Shaw-Lecerf, E. Lara Lash, Kenneth R. Lyons, David Murakami, Nettie Roozeboom, Jie Li, Nicholas Califano</i>	
Invited: Error Estimation for Unsteady Pressure Sensitive Paint Measurements .....	186
<i>David D. Murakami, Lawrence Hand, Kenneth Lyons, Marc Shaw-Lecerf, E. Lara Lash, Nettie Roozeboom, Nicholas Califano, Jie Li</i>	

## **VELOCIMETRY II**

Laser Spark Velocimetry in Hypervelocity Expansion Tunnel Using a 250 kHz Dot-Schlieren.....	200
<i>Boris S. Leonov, Farhan Siddiqui</i>	
Investigation of Instantaneous Velocity-Fields by Schlieren Image Velocimetry Using Ray-Traced Simulated Focusing-Schlieren Images .....	209
<i>Toshinori Kouchi, Narumi Kodera, Kento Tanaka, Hiroki Suzuki</i>	
Holographic Cross-Correlation Analysis for Velocity Characterization of Liquid Jets in Supersonic Crossflows.....	226
<i>Eric Douglas, Andy X. Zheng, Andrew W. Marsh, Joshua A. Johnson, Suresh Menon, Yi C. Mazumdar</i>	
Laser Spark Evaluating InFlow (LASEI) .....	236
<i>Laura Simurda, Avraham Gileadi, James T. Heineck, Nestor Cano</i>	
Multi-Point Velocimetry and Density Measurement in a Boundary Layer Over an Airfoil in a Lab Scale Wind Tunnel Using Single Shot Coherent Rayleigh Brillouin Scattering .....	249
<i>Atulya U. Kumar, Stefan Karatodorov, Marios Kounalakis, David H. Covert, Alexandros Gerakis</i>	

## **INSTRUMENTATION AND DIAGNOSTIC TECHNIQUES FOR HIGH-SPEED AIR-BREATHING PROPULSION II**

Quantitative Infrared Absorption Measurements of Vapor-Phase Fuel in a Supersonic Flow.....	260
<i>Joel Van Der Lee, Weronika Senior-Tybora, Rudy Kaner, Joseph Lefkowitz, Dan Michaels</i>	
Structure and Stabilization Mechanisms of an Ethylene-Air Flame in Supersonic Co-Flow.....	272
<i>Nicholas L. Strahan, Reed T. Geiger, William B. Deverter, William D. Greder, Rohan Gejji, David M. Peterson, Carson D. Slabaugh</i>	
Optical Diagnostics of Cavity-Stabilized Combustion in an Axisymmetric Dual-Mode Supersonic Combustion Flowpath.....	295
<i>Jie Lim, Gyu Sub Lee, Isabella Gessman, Arthur Paganini, Tonghun Lee</i>	

## **VELOCIMETRY III**

Simultaneous PIV and SAFS Measurements of the Coupled Dynamics of a Jet Impinging on a Heated Wall.....	308
<i>Gauresh R. Jassal, Bryan E. Schmidt</i>	
Particle Image Velocimetry for Ion Wind Thruster Measurement in Low Density Atmosphere.....	318
<i>David Noelle, Sebastian Schubert, Veit Hildebrand, Harald Pfifer</i>	
Cross-Measurement Comparisons for a CFD Validation Dataset on Mach 2.5 Axisymmetric Turbulent Shock-Wave/Boundary-Layer Interactions.....	333
<i>Heath H. Reising, Jonathan Sasson, David O. Davis, David Friedlander, Layton W. Howerton</i>	
Comparison of Event Camera Processing Algorithms for Experimental 2D2C Velocimetry.....	369
<i>Sidaard Gunasekaran, Michael Mongin, Osama A. Alsattam, Keigo Hirakawa</i>	
Deep Learning Based Particle Inertia Bias Corrector for Particle Image Velocimetry.....	388
<i>Dilip Kalagotla, Paul Orkwis, Daniel R. Cuppoletti</i>	

## **RDE MEASUREMENT AND DIAGNOSTICS I**

Synthetic LAS Measurements of Combustion Efficiency in a Rotating Detonation Engine Using 3D-DNS Data.....	411
<i>Jose Guerrero, Mirko Gamba</i>	
Combustion Efficiency Measurements in a Rotating Detonation Engine Using Scanned-Wavelength-Modulation Spectroscopy.....	431
<i>Jose Guerrero, Mirko Gamba</i>	
High-Speed Visualization of Spray Breakup and Velocity Estimation in a Rotating Detonation Combustor Using Laser Induced Fluorescence.....	442
<i>Matthew Hoeper, Robert B. Wang, Peter Salek, Zoe Brand, Austin M. Webb, Venkat Athmanathan, Terrence R. Meyer, Christopher Fugger, Hugh D. Perkins</i>	
Experimental Validation of a Robust Laser Spectroscopic Instrument in a Detonation Environment.....	457
<i>Andrew M. Derusha, Nishan Khanal, Marc B. Etienne, Daniel R. Dyson, Justin Urso, Subith Vasu</i>	

## **APPLIED SPECTROSCOPIC MEASUREMENTS I**

Chirped-Pulse Laser Absorption Imaging of Ablation Products Formed in Hypersonic Shock-Tunnel Experiments.....	464
<i>Charles J. Schwartz, Jonathan J. Gilvey, Christopher S. Goldenstein, Charley Downing, Bradley Lyon, Joshua Hargis, Kyle P. Lynch, Justin L. Wagner</i>	
TDLAS Doppler Velocimetry for Characterization of a Shock Tube Facility .....	473
<i>Jonathan P. McGaunn, Louis A. Vest, Michelle Franzen, Nishan Khanal, Marc B. Etienne, Gabriel Duany Izaguirre, Justin Urso, Subith Vasu</i>	
CN Laser Absorption Measurements at Extreme Conditions in a Free-Piston Shock Tube .....	486
<i>William Swain, Elijah Jans, Charley Downing, Kyle P. Lynch, Kyle Daniel, Justin L. Wagner</i>	
Post-Incident Shock Wave Measurements of Gas Properties at 1 MHz Using Scanned-Wavelength-Modulation Spectroscopy .....	495
<i>Jose Guerrero, Mirko Gamba</i>	
High-Speed Rotational Spectroscopy of the Hydroxyl Radical Behind Detonation Waves .....	510
<i>Nicholas Kuenning, Brett A. Honaker, Sebastián G. Perez, Ariya L. Olaee, Raymond M. Spearrin</i>	
Multi-Color Scanned Wavelength Direct Absorption Sensor For Line Strength Validation at High-Temperature Conditions .....	518
<i>Nishan Khanal , Marc B. Etienne, Andrew M. Derusha, Louis A. Vest, Jonathan P. McGaunn, Justin Urso, Subith Vasu</i>	

## **PSP AND TSP MEASUREMENTS I**

A Temperature-Corrected Ruthenium and Inorganic Phosphor-Based Fast Responding Pressure Sensitive Paint .....	531
<i>Orian Le Bourgeois, François Nicolas, Marie Couliou, Benoît Fond</i>	
Temperature and Pressure Imaging on Fast Rotating Blades Using PSP and Thermographic Phosphors .....	541
<i>Georgios Kasapis, François Nicolas, Benoît Fond</i>	
Benchmark Comparison of Infrared Thermography and Temperature Sensitive Paint on a Cone-Cylinder Model in Laminar Mach 7 Flow .....	552
<i>Cary D. Smith, Mark Gragston, Sophia Edwards, Jacob Jenkins, Farhan Siddiqui</i>	
Challenges of Applying Temperature-Sensitive Paints to Hypersonic Flow Conditions.....	565
<i>Nicholas Slusher, Hirotaka Sakaue, Yasuhiro Egami, Daiki Kurihara, Masafumi Yamazaki, Kento Nagao</i>	

## **RDE MEASUREMENT AND DIAGNOSTICS II**

Experimental Study of Ion Probe Configuration for Detonation Wave Speed Measurements in a Linear Detonation Tube .....	575
<i>Olivia Decaro, Ruthie Hill, Kunning G. Xu</i>	
Spatially and Temporally Synchronous OH* and CH* Chemiluminescence Imaging in the Exhaust of a Rotating Detonation Engine .....	591
<i>Ashley James, Dalton G. Langner, Apurav Gupta, Ajay K. Agrawal</i>	

Regression Analysis of Detonation Wave Speed in a Flow-Through Rotating Detonation Combustor .....	603
<i>Peter H. Glaubitz, Anthony J. Centofanti, Tyler C. Pritschau, Ephraim Gutmark</i>	

## **1D, PLANAR, AND VOLUMETRIC MEASUREMENTS**

Towards 4D Emission Tomography of Reacting Waves.....	609
<i>Amit K. Singh, Joseph P. Molnar, Mateo Gomez, Robert T. Fievisohn, Samuel J. Grauer</i>	
Four-Dimensional Imaging of Supersonic Projectile and Rain Droplet Impact .....	622
<i>Mateo Gomez, Jacob P. Pearson, Jakob Y. Harbers, Brandon W. Yant, Sukesh Roy, Terrence R. Meyer, Nicholas Mueschke</i>	
Tomographic Background-Oriented Schlieren Facility for Buoyancy-Driven Flows and Flames .....	637
<i>Reese A. Peck Cowles, Joseph P. Molnar, Amit K. Singh, Samuel J. Grauer</i>	
Experimental Proof-of-Concept of a Time-Resolved Gridless Tomography Method for 3D Scalar Fields .....	651
<i>Dustin L. Kelly, Brian S. Thurow</i>	
Algorithm for Time-Resolved Background-Oriented Schlieren Tomography Applied to High-Speed Flows .....	666
<i>Joseph P. Molnar, Samuel J. Grauer</i>	
Recent Progress and Development of Self-Aligned Focusing Schlieren.....	681
<i>Wayne E. Page, Matthew T. Boyda, Timothy W. Fahringer, Joshua M. Weisberger, Brett F. Bathel, Mark Wernet, James T. Heineck</i>	

## **PSP AND TSP MEASUREMENTS II**

Effect of Spray Coating Parameters on the Characteristics of Dye-Painted Anodized Aluminum Pressure-Sensitive Paint .....	709
<i>Yuma Kawamata, Takeru Kawashima, Daiju Numata</i>	
Imaging Measurements of Surface Heat Flux from Shock-Boundary Layer Interaction in Low Enthalpy Mach 4 Flow .....	719
<i>Cary D. Smith, Mark Gragston, Sophia Edwards, Nicholas Webber</i>	
Lifetime-Based, Pressure-Sensitive Paint Measurements Using Single Photon Avalanche Diode Sensor Array .....	735
<i>Dimitrios Tsioumanis, Mark K. Quinn, Paul J. White, Jonathan P. Stevenson</i>	
Dual-Luminophore Pressure-Sensitive Paint Measurement of Vertical Tail Model Using Three-Gate Lifetime Method With Photodegradation Correction.....	745
<i>Kazuki Uchida, Kazuyuki Nakakita, Taku Nonomura</i>	
Pressure-Sensitive Paint Measurements of Supersonic Micronozzles With Secondary Flow Injection.....	760
<i>Yi-En Tsai, Chih-Yung Huang</i>	

## **APPLIED SPECTROSCOPIC MEASUREMENTS II**

Revisit of Common Old Ordinary Raman Scattering (COORS): Localized One-Dimensional Diagnostics of Hypersonic Flows.....	767
<i>Junhwi Bak, Boris S. Leonov, Richard B. Miles</i>	
Hypersonic Shock Wave-Boundary Layer Interaction in a Shock Tunnel Using Nitric Oxide Laser Induced Fluorescence.....	773
<i>Elijah Jans, Kyle Daniel, William Swain, Charley Downing, Kyle P. Lynch, Sean P. Kearney, Justin L. Wagner</i>	
Towards Simultaneous Multi-Parameter Measurements Using Burst-Mode Frequency-Scanning Planar Laser-Induced Fluorescence.....	784
<i>Amanda Braun, Neil S. Rodrigues, Paul M. Danehy</i>	
Temperature Measurements in Air Using an Atomic Vapor Based Dispersion Filter.....	795
<i>Robert T. Randolph, Eric Finberg, Rahul Ayanampudi, Junhwi Bak, Richard B. Miles</i>	
1D Flame Thermometry Using Femtosecond LIF of NO.....	805
<i>Matthew K. Hay, Manuel Suarez, Waruna D. Kulatilaka</i>	

## **COMBUSTION DIAGNOSTICS I**

sCMOS-Based Raman/Rayleigh Spectroscopy for Quantitative Detection of Temperature, Major Species, and Pressure in Supersonic Combustion.....	813
<i>Hao Tang, Jonathon H. Miller, Adam M. Steinberg</i>	
10 kHz OH-PLIF Measurements at the Exit of a Full-Annular Small-Scale Combustor.....	822
<i>Nicholas Rock, Mateo Gomez, Christopher Fugger, Brendan Paxton, Aaron W. Skiba, Brent A. Rankin</i>	
Laser Absorption Measurements of HCl in a Shock Tube for Investigating the Chemical Kinetics of Rocket Propellants.....	832
<i>Claire M. Gregoire, Eric L. Petersen</i>	
Concentration and Temperature Measurements in Swirling Hydrogen Flames in a Micromix Based Fuel-Flex Combustor.....	839
<i>Yazdan Naderzadeh Ardebili, Scott Watson, Gilles Bourque, Sandeep Jella, Marc Furi, Swetaprovo Chaudhuri</i>	

## **VOLUME 2**

## **COMBUSTION DIAGNOSTICS II**

Optical Measurements of Pressurized HTPB Combustion.....	856
<i>Clayton M. Geipel, Brian T. Bojko, Christopher J. Pfützner, Brian T. Fisher, David A. Kessler</i>	
Particle Image Velocimetry Method to Determine Burning Velocity and Particle Burn Time in a Metal Dust Flame.....	867
<i>Vidhan Malik, Christopher J. Pfützner, Brian T. Fisher</i>	
High Speed, Multi-species, Two-Dimensional Raman Scattering Measurements for Bluff-Body Stabilized Turbulent Flames at High Pressures.....	878
<i>Manya Subbaramaiah, Hao Tang, Oleksandr Bibik, Adam M. Steinberg</i>	



Laser-Induced Incandescence Measurements in a High-Pressure Swirl-Stabilized Flame ..... 887  
*Thomas McLean, Keaton C. Koenig, Benjamin K. Murdock, Tristan T. Shahin, Alexander J. Hodge, Rohan Gejji, Carson D. Slabaugh, Robert P. Lucht*

Direct Combustion Noise: Experimental Study on the Pressure - Heat Release Coherence ..... 904  
*Sungyoung Ha, Tim Lieuwen*

### **MEASUREMENTS IN CHALLENGING ENVIRONMENTS I**

Supersonic Projectile and Rain Droplet Impact and Resultant Projectile Damage Measurements ..... 914  
*Jakob Y. Harbers, Jacob P. Pearson, Mateo Gomez, Brandon W. Yant, Sukesh Roy, Terrence R. Meyer, Nicholas Mueschke*

Feasibility Assessment of High-Enthalpy Test Capability Using a Green-Propellant Hybrid Gas Generator ..... 930  
*Stephen A. Whitmore*

Quantitative Particle Diagnostics in Post-Detonation Fireballs ..... 969  
*Cohen Nunes, Rebekah L. Travis, Daniel R. Guildenbecher*

### **INVITED: DEVELOPMENTS AND ADVANCES IN BACKGROUND ORIENTED SCHLIEREN**

Twenty-Five Years of Background-Oriented Schlieren: Advances and Novel Applications ..... 981  
*Bryan E. Schmidt, Brett F. Bathel, Samuel J. Grauer, Michael J. Hargather, James T. Heineck, Markus Raffel*

### **NOVEL INSTRUMENTATION, PROBES, AND SENSORS I**

Silica-Based P/C-PSP Performance and Application to Wind Tunnel Experiment ..... 1026  
*Masaki Okawa, Yuma Yamagishi, Kanako Watanabe, Tsubasa Ikami, Hiroki Nagai*

Direct and Simultaneous Measurement of Wall-Heat Flux and Temperature in a Shock Tube by Atomic Layer Thermopiles ..... 1036  
*Claudia Hofmann, Simon Kaneider, Tim Rödiger, Ralf Brederlow, Jan-Erik Brune, Lukas Jakobs, Tobias Sander, Christian Mundt*

Practical Considerations Using Weighted-Acceleration Compensation Techniques for Dynamic Force Measurements in Wind Tunnels ..... 1049  
*Garrett L. Trowbridge, Nicholas A. Vlajic, Devin E. Burns*

Comparison of Pressure Fields Around a Five-Hole Probe and Kiel Probe ..... 1064  
*Joseph O'Neill, Mark W. McQuilling*

Effects of Intrusive Probes on Incident and Reflected Regions of a Shock Tube ..... 1074  
*Louis A. Vest, Lucas Pitts, Juan Cruz Pellegrini, Isabelle Kaltenbaugh, Subith Vasu*

### **OTHER TOPICS IN AMT I**

Flow-Induced Vibrations in High-Aspect-Ratio Wings Using DIC and PTV Analysis ..... 1084  
*Mostafa Khazaei Kuhpar, Banafsheh Seyed-Aghazadeh*

3D Turbulent Jet Flow Statistics Using Five-Hole Probe and Hot-Wire Anemometry .....	1094
<i>Matthew William, Mark W. McQuilling</i>	
A Comparison of Secondary Kinetic Energy Definitions Using Time-Resolved Flow Field Measurements in a Turbine .....	1104
<i>Maria Rozman, Margaret Nunn, Michael Barringer, Karen Thole, Reid Berdanier</i>	
Measurement of Aluminum Agglomerates at Elevated Pressures Using Digital Inline Holography.....	1124
<i>Rees P. Verleur, Amogh Natu, Jonathan Martin, Daniel R. Guildenbecher</i>	
Development of a Digital Inline Holography Technique to Characterize Airborne Supercooled Water Droplets and Ice Crystals for Aircraft Icing Studies .....	1134
<i>Jincheng Wang, Edward Chumbley, Harsha Sista, Amrit Kumar, Hui Hu, Shyam Kumar, Jiarong Hong</i>	
Visualizing Jets in Crossflow With Classic Schlieren .....	1145
<i>Sreelekshmi Sreekumar, Michelle Franzen, Louis A. Vest, Marley A. Albright, Justin Urso, Subith Vasu</i>	

## **VELOCIMETRY I**

FLEET Velocimetry at 100 kHz in Hypersonic Flows .....	1153
<i>Adrian Nordstrom, Santiago P. Mercado Barrero, Arthur Dogariu</i>	
FLEET Velocimetry Measurements of the Mach 4 Nozzle Flow of the ONR-UTA Arc Jet Facility .....	1163
<i>Nikhil Chander, Luca Maddalena, Daniel Palmquist</i>	
Wake Velocimetry of a Sphere-Cone Model in a Mach 10 Air Freestream Using FLEET.....	1179
<i>Neil S. Rodrigues, Olivia K. Tyrrell, Brian R. Hollis, Paul M. Danehy</i>	
LaITER: A Multi-Physics Approach to Molecular Tagging Velocimetry .....	1197
<i>Fynn Reinbacher, Sarang Bidwai, James B. Michael</i>	
Hypersonic FLEET Velocimetry on a Three-Dimensional Expansion-Compression Geometry .....	1208
<i>Douglas W. Carter, John C. Pehrson, Rajkumar Bhakta, Russell Spillers, Steven J. Beresh</i>	

## **HIGH-SPEED FLOW MEASUREMENTS II**

High Bandwidth Optical Emission Spectroscopy Sensor for Ground Testing and Future Hypersonic Flight .....	1216
<i>Alexander D. Plumadore, Aman Satija, Dan J. Londrico, Robert P. Lucht</i>	
Transitional High-Enthalpy Boundary-Layer Measurements by ALTP Heat-Flux Sensors .....	1230
<i>Jan-Erik Brune, Lukas Jakobs, Tobias Sander, Claudia Hofmann, Tim Rödiger, Christian Mundt</i>	
Axisymmetric Laminar Hypersonic Boundary Layer Profile Measurements Using Tangentially Oriented FLEET Velocimetry .....	1242
<i>Nicholas Webber, Sophia Edwards, Mark Gragston</i>	
Internal Temperature Measurement of Low Temperature Ablators in Mach 7 Flow .....	1255
<i>Joseph Gonzales, Kojiro Suzuki, Hirotaka Sakaue</i>	

## **INVITED: DEVELOPMENTS AND ADVANCES IN FLDI**

- Focused Laser Differential Interferometry: Recent Developments and Applications for Flow Measurements..... 1269  
*Elizabeth K. Benitez, Andrew Ceruzzi, Mark Gragston, Nick J. Parziale, Bryan E. Schmidt, Joshua M. Weisberger*

## **DATA ANALYSIS TECHNIQUES AND DATA-DRIVEN VALIDATION**

- An Evaluation of Yaw Moment Driven by Rotor-Fuselage Interactions ..... 1330  
*Mario G. Vignali, Leah Newton, Darrell Nieves Lugo, Jackson Asiatico, Michael P. Kinzel*
- Advanced Data Processing Routines to Characterize Droplets Exposed to Shockwaves Generated by Hypervelocity Projectiles ..... 1344  
*Gavin Lukasik, Ferris Turney, Thomas Lacy, Waruna D. Kulatilaka*
- Reconstructing Volumetric Flow in the Wake of a Rigid Airfoil Using 2D Flow Field Data..... 1365  
*Mohammadhossein Kashefi, Mostafa Khazaei Kuhpar, Banafsheh Seyed-Aghazadeh*

## **HIGH-SPEED FLOW MEASUREMENTS I**

- Modification of Mach 6 Freestream Flow by Pitot Probe Bow Shock as Measured by Line FLDI and SAFS..... 1372  
*Joshua M. Weisberger, Brett F. Bathel, Gregory C. Herring, Wayne E. Page*
- Simulated Focused Laser Differential Interferometry of the Hypersonic Second-Mode Instability ..... 1400  
*Elizabeth K. Benitez, Matthew P. Borg, Sean D. Dungan, Christoph Brehm, Joseph S. Jewell*
- Optical Distortion in a Hypervelocity Ground Test Facility..... 1418  
*John Pallotta, Charles Atkinson, Farhan Siddiqui, Bret Van Poppel, Rodney Bowersox*
- Inverse Decomposition Method for Complete Determination of Freestream Disturbances in a Hypersonic Wind Tunnel..... 1430  
*Rolf Radespiel, Giuseppe A. Rosi, Kübra Soy, David E. Rival, Jean-Marc Heinricy, Wolfgang Schroeder*
- Application of a Novel Multi-QCL for High-Temperature Combustion Diagnostics Inside Shock Tubes ..... 1443  
*Gabriel Duany, Jonathan P. McGaunn, Farhan Arafin, Justin Urso, Arkadiy Lyakh, Subith Vasu*

## **COMBUSTION, DETONATION, AND PROPULSION MEASUREMENTS I**

- Hybrid fs/ps Coherent Stokes Raman Scattering Measurements for a CH<sub>4</sub>/O<sub>2</sub> Shear Coaxial Injector ..... 1451  
*Alexander M. Warner, Ryan Strelau, Will C. Senior, Rohan Geji, Robert P. Lucht, Carson D. Slabaugh*
- Near-Surface Thermometry and Timescales of Polyoxymethylene Counterflow Diffusion Flame Using Hybrid fs/ps CARS ..... 1461  
*Sarang Bidwai, Michael A. Welch, James B. Michael, Gregory Young*

Coherent Control for Selective Excitation of Combustion Species in a Benchtop Flame Using fs/ps CARS .....	1474
<i>Anna Stevenson, Chloe E. Dedic</i>	

## **MEASUREMENTS IN CHALLENGING ENVIRONMENTS II**

Preliminary Optimization of fs/ps-CARS Thermometry in the ONR-UTA Arc-Jet Facility .....	1486
<i>Ian M. Raybon, Luca Maddalena, Laura E. Dogariu, Arthur Dogariu</i>	
Expanding the Measurement Capabilities of the mARC II Arc-Jet to Map the Operating Envelope for High-Enthalpy Air Flows .....	1497
<i>Jocelino Rodrigues, Megan E. Macdonald, Magnus Haw, Ramon Martinez, Daniel Philippidis, Sebastian Colom, Ryan J. Chung, Joe Hartman</i>	
Emission Spectroscopy in the Converging-Diverging Nozzle of an Hypersonic Arcjet Tunnel .....	1510
<i>Killian E. Samuels, Christian T. Isaacs, Damiano Baccarella</i>	

## **NOVEL INSTRUMENTATION, PROBES, AND SENSORS II**

Directed Illumination of Sunlight Collimated and Observed Beneath a Lunar Lander (DISCOBaLL): Structured Illumination For a Lunar Surface Photogrammetry System.....	1529
<i>William C. Eshleman, Olivia K. Tyrrell, Joshua M. Weisberger, Josiah Walker, Paul M. Danehy</i>	
Application of Adaptive Optics for Improvement Spatial Resolution of High-Speed-BOS Through Turbulence .....	1546
<i>Toshiharu Mizukaki, Ryota Ozawa, Takeo Minezaki, Shin Oya</i>	
A Two-Color Heterodyne Interferometer for High-Speed Measurement of Electron Density .....	1550
<i>Rishav Choudhary, Bilal Hassan, Kaeshav Chandrasekar, Tyler Linfesty, Alejandro R. Quintero, Christopher Limbach, Yue Wu, Jacob George</i>	
Wind Gust Simulation System Within Subsonic Wind Tunnel at the University of Arizona .....	1560
<i>Kylar Nietzel, Adrien Bouskela, Paul Dybskiy, Colby Thomas, Sergey V. Shkarayev</i>	

## **COMBUSTION, DETONATION, AND PROPULSION MEASUREMENTS II**

Comparative Study of Digital In-Line Holography and Phase Doppler Particle Analysis for LPP Combustion .....	1584
<i>Steven M. Budzinski, Ijeoma Obi, Samuel E. Wonfor, Jeremiah Juergensmeyer, Adam M. Steinberg, Yi C. Mazumdar</i>	
Aluminum Powder Oxidation in a Hydrogen-Oxygen Post-Detonation Environment.....	1592
<i>Daniel R. Dyson, Hamil Patel, Rodrigo I. Yuraszeck, Alejandro J. Puerta-Alvarado, Subith Vasu, Ryan W. Houim</i>	
High Magnification Holography for Characterizing Multi-Phase Detonation Breakup .....	1599
<i>Nathan M. Moore, Andrew W. Marsh, Matthew Christie, Yi C. Mazumdar</i>	
Data Processing Techniques for Emission Spectroscopy in Detonation Environments .....	1611
<i>Hamil Patel, Daniel R. Dyson, Rodrigo Yuraszeck, Alejandro J. Puerta-Alvarado, Subith Vasu, Ryan W. Houim</i>	

On the Use of Filtered Rayleigh Scattering in High Temperature Engine Exhaust Conditions..... 1617  
*Keaton J. Hanley, Evan Warner, Ashwin Kumar, Gwibo Byun, Kevin T. Lowe, Joseph W. Meadows*

Frequency-Scanning Filtered Rayleigh Scattering Measurements for the Mixtures of C3 and n-C4  
Hydrocarbon Fuels with Nitrogen at Elevated Pressures ..... 1630  
*Utkun E. Malkocoglu, Gwibo Byun, Kevin T. Lowe*

### **MEASUREMENTS IN CHALLENGING ENVIRONMENTS III**

Towards Wall-Normal Fluctuation Measurements in a Mach 6 Turbulent Boundary Layer ..... 1648  
*Ben Segall, Nick J. Parziale, Tim C. Keenoy, David Shekhtman*

Freestream Multi-Species and Near-Body Atomic Oxygen Measurements in the T5 Shock Tunnel  
by Tunable Diode Laser Absorption Spectroscopy..... 1659  
*Tal Schwartz, Dylan Drescher, Spencer C. Barnes, Michele Ferretti, Christopher Strand,  
Ronald K. Hanson, Ying Luo, Wesley M. Yu, Jorge Rodriguez Gutiérrez, William Feasey,  
Joanna M. Austin, Hans G. Hornung, Thomas Gross, Thomas Schwartzentruber*

Shock Tube ARAS Measurements of N(2D) and N(2P) in 5100 K to 6400 K Nitrogen-Argon  
Mixtures ..... 1681  
*Zev N. Granowitz, Dylan Drescher, Devin Merrell, Jesse W. Streicher, Christopher Strand,  
Ronald K. Hanson*

Second-Generation In-Situ TDLAS Sensor for Supersonic Gas Measurements in a Shock Tube ..... 1695  
*Tal Schwartz, Christopher Strand, Ronald K. Hanson, Christopher B. Kostyk*

Simultaneous Point Measurements of Temperature, Pressure, and Velocity Using Spectrally  
Resolved Laser-Induced Fluorescence of Atomic Potassium Vapor in Air ..... 1705  
*Joshua Vandervort, Konstantinos Kotsarinis, Christopher Strand, Ronald K. Hanson*

### **Author Index**