We, the scientific committee, are very pleased to welcome you to the 5th Ablation Workshop in Lexington, Kentucky. Many thanks to the University of Kentucky and Prof. Alexandre Martin, We, the scientific committee, are very pleased to welcome you to the 5th Ablation Workshop in Lexington, Kentucky. Many thanks to the University of Kentucky and Prof. Alexandre Martin, head of the Local Organizing Committee, for his initiative and active fundraising to ensure continuation of this workshop in such a picturesque venue!

The Ablation Workshops, steered by NASA, AFOSR and Sandia, provide a single meeting point for the integration and advancement of a multi-disciplinary research community of scientists and engineers working on aerothermodynamic ablation. This growing research community has members representing government agencies, the private sector, and university systems across the world. The primary objectives of the workshop are to:

1. foster improved communication across international boundaries;
2. expose the aerothermodynamic ablation modeling community to new ideas and techniques from adjacent disciplines;
3. bring new experimental techniques to bear on the problem; and
4. discuss challenges faced in adapting existing techniques to address new applications.

This year, the workshop will focus on the development, validation and uncertainty quantification of the high-fidelity models used to simulate the behavior of ablative materials. Sessions and comparison activities will be held on the various aspects of modeling the surface and in-depth performance of ablative materials, experimental techniques to validate the resulting models, and uncertainty quantification methodologies. The state of the art of ablation modeling has changed little in the past 40 years, largely because of a lack of validation data with which to justify improvements to the baseline models. However, in recent years significant progress has been made on the numerical side, and it is now time to develop a set of validation experiments to test key aspects of the new and proposed models, quantify remaining uncertainties, and prioritize limited research budgets on those aspects that will have the largest impact on minimizing mass and maximizing reliability of spacecraft thermal protection systems.

This workshop will take a break in 2013, but for a good cause. The proposal submitted by Dr. Cozmuta to the Gordon Research Council to initiate a Gordon Research Conference in the area of “Atmospheric Reentry Physics” was approved by the board and the first conference will take place February 3rd-8th of 2013 in Ventura, California. This is a great opportunity that ensures continuity for the community to meet and discuss technical topics of high interest in this area. We anticipate that the Ablation Workshop will return in 2014.

Thank you for coming! Please participate, learn something, and above all, have fun!

Dr. John D. Schmisseur, Air Force Office of Scientific Research, USA
Dr. Michael J. Wright, NASA Ames Research Center, USA
Dr. Jeffrey L. Payne, Sandia National Laboratories, USA
Dr. Ioana Cozmuta, STC Corporation, NASA Ames Research Center, USA
Tuesday, February 28, 2012

Introduction and Overview
Chair: Alexandre Martin, University of Kentucky, USA

7:30 a.m.  Breakfast and Registration
8:30 a.m.  Introduction: the 5th Ablation Workshop and beyond
Alexandre Martin, University of Kentucky, USA
Ioana Cozmuta, STC/NASA Ames, USA
8:50 a.m.  Merging Aerothermodynamic and High-Temperature Materials Research: An AFOSR Perspective
John Schmisseur, Air Force Office of Scientific Research, USA
9:15 a.m.  Overview of ablation modeling and simulation at Sandia National Laboratories: past, present and future
Micah Howard, Sandia National Lab., USA
9:40 a.m.  Preparing NASA for the 21st Century: OCT perspective on EDL
Harry Partridge, NASA Headquarters, USA
10:05 a.m. Questions and discussions
10:20 a.m. Coffee Break and Poster Session

New Developments in Ablation Science – I
Chair: Michael J. Wright, NASA Ames, USA

10:35 a.m. SPRITE: A TPS test bed for ground and flight
Dinesh K. Prabhu, ERC Inc./NASA Ames, USA
11:00 a.m. Characterization of material response during arc jet testing with optical methods status and perspectives
Michael W. Winter, UC Santa Cruz/NASA Ames, USA
11:25 a.m. Direct observation of mechanical ablation
Charles Powars, Saint Croix Research, USA
11:50 a.m. Questions and discussions
12:00 p.m. Lunch
1:30 p.m. The Mysteries of Real Materials
Bernard Laub, NASA Ames, USA

Keynote Presentation

2:00 p.m. A Perspective on the Design and Development of the SpaceX Dragon Spacecraft Heatshield
Daniel J. Rasky, NASA Ames, USA

Ablation Code Intercomparison
Chair: Mark Ewing, ATK, USA

2:30 p.m. Ablation test case series #2
Jean R. Lachaud, UC Santa Cruz/NASA Ames, USA
3:00 p.m. Ablation Thermochemistry for TACOT
Micah Howard, Sandia National Lab., USA
3:15 p.m. Questions and discussions
3:45 p.m. Coffee Break and Poster Session
4:00 p.m. Ablation Test Case Series #2: results and discussion
4:55 p.m. Ablation test case series #3
Tom van Eekelen, LMS-SAMTECH, Belgium
5:25 p.m. Group discussion
5:40 p.m. Experimental test case
Alexandre Martin, University of Kentucky, USA
6:00 p.m. Adjourn
Wednesday February 29, 2012

**Coupling of Material Response and Aerothermal Models**
*Chair: John Schmisseur, Air Force Office of Scientific Research, USA*

7:30 a.m.  Breakfast and Registration
8:15 a.m.  Ablation Modeling of a Solid Rocket Nozzle  
*Mark E. Ewing, ATK, USA*
8:40 a.m.  Modeling of heat transfer attenuation by ablative gases during the Stardust re-entry  
*Alexandre Martin, University of Kentucky, USA*
9:05 a.m.  A radiative transfer equation solver module for coupled simulation of hypersonic flow with ablation  
*Ranjan S. Mehta, CFD Research Corporation, USA*
9:30 a.m.  CFD Ablation predictions with coupled GSI modeling for charring and non-charring materials  
*Alessandro Turchi, University of Rome “La Sapienza”, Italy*
9:55 a.m.  Coffee Break and Poster Session
10:10 a.m. Uncertainty analysis of reaction rates in a finite rate gas-surface model  
*Thomas E. Schwartzentruber, University of Minnesota, USA*
10:35 a.m. Coupled computation of fluid and material response for non-charring ablative materials in hypersonic flow  
*Jonathan Wiebenga, University of Michigan, USA*
11:00 a.m. Thermo-chemical and mechanical coupled analysis of swelling, charring and ablative materials for reentry applications  
*Gregory Pinaud, Astrium, France*
11:25 a.m. Real-Time Ablation Recession Rate Sensor System for Advanced Reentry Vehicles  
*George Papadopoulos, ATK, USA*
11:50 a.m. Questions and discussions
12:00 a.m. Lunch

**Oxidation Studies**
*Chair: Erica Corral, University of Arizona, USA*

1:30 p.m.  Methodology for ablation investigations of innovative ablators in the VKI plasmatron facility: first results on a carbon fiber preform  
*Bernd Helber, von Karman Institute, Belgium*
1:55 p.m.  Oxidation Behavior of Ultra-High Temperature Ceramics Using Dynamic Non-Equilibrium TGA  
*Erica Corral, University of Arizona, USA*
2:20 p.m.  Aerothermal Characterization of silicon carbide based TPS in high-enthalpy airflow  
*Olivier Chazot, von Karman Institute, Belgium*
2:45 p.m.  Graphite ablation experiments in the LHMEL laser facility  
*Ryan Gosse, Air Force Research Lab., USA*
3:10 p.m.  Questions and discussions
3:25 p.m.  Coffee Break and Poster Session

**Chemistry of Thermal Decomposition**
*Chair: Jean R. Lachaud, UC Santa Cruz/NASA Ames, USA*

3:40 p.m.  Pyrolytic analysis of a charring ablator  
*Alexandre Bennett, Dstl, United Kingdom*
4:05 p.m.  A combined experimental and mechanistic modeling approach to study polymer pyrolysis  
*Hsi-Wu Wong, Aerodyne Research, USA*
4:30 p.m.  Study of mechanical and thermal behavior of polymeric ablator using MD  
*Abhishek Kumar, University of Michigan, USA*
4:55 p.m.  Investigation of Pyrolyzing Ablator in an Inductively Coupled Plasma Torch Facility  
*Douglas G. Fletcher, University of Vermont, USA*
5:25 p.m.  Questions and discussions
5:30 p.m.  Adjourn

**Off site activity**
6:15 p.m.  Banquet “Taste of Kentucky” at Buffalo Trace Distillery
Thursday March 1st, 2012
UQ for Material Response and Aerothermal
Chair: Ioana Cozmuta, STC/NASA Ames, USA

7:30 a.m.  Breakfast and Registration
8:30 a.m.  Ablative Thermal Protection System Study
          Lawrence L. Green, NASA Langley, USA
8:55 a.m.  Efficient UQ and Sensitivity Analysis for Hypersonic Flow and Material Response Simulations under inherent and model-form uncertainties
          Serhat Hosder, Missouri University of Science and Technology, USA
9:20 a.m.  A statistics-based material property analysis to support ablation simulation UQ efforts
          Sean R. Copeland, Stanford University, USA
9:45 a.m.  3D microstructural characterization of materials
          Ryan M. White, North Carolina State University, USA
10:10 a.m. Questions and discussions
10:20 a.m. Coffee Break and Poster Session

New Developments in Ablation Science – II
Chair: Ioana Cozmuta, STC/NASA Ames, USA

10:35 a.m. Ultrasonic thermometry for recession measurements in ablative materials
          Donald Yuhas, Industrial Measurement Systems Inc, USA
11:00 a.m. On the modelling of high speed turbulent flows with applications towards reentry ablation
          Rodney D. W. Bowersox, Texas A&M, USA
11:25 a.m. An adjoint method to determine the effective material properties of an ablator
          Emma Johnstone, Fluid Gravity Engineering LTD, United Kingdom
11:50 a.m. Questions and discussions
12:00 p.m. Outcome of the workshop and future directions
          Alexandre Martin, University of Kentucky, USA
12:20 p.m. Group discussion
12:30 p.m. Adjourn

Posters

Investigation of blowing effects on turbulent flow over a rough surface
          Mark Miller, University of Kentucky, USA

Numerical investigation of three-dimensional effects within a charring ablator
          Alexandre Martin, University of Kentucky, USA

DST-Shells used as an Ablative Material
          Vicky Kurtz, Deep Springs Technology, USA

Advanced thermal protection systems (TPS) and transition analysis
          Luca Maddalena, University of Texas at Arlington, USA

Development and validation of SACRAM: a Swiss Approach to the Computational Response of an Ablative Material
          Ojas Joshi, École Polytechnique Fédérale de Lausanne, Switzerland

Computation of Surface Catalysis for Graphite Exposed to high enthalpy nitrogen flow
          Abhilasha Anna, University of Michigan, USA

Computational Chemistry modelling of the oxidation of highly oriented pyrolytic graphite
          Savio Poovathingal, University of Minnesota, USA

Dynamic non-equilibrium thermal gravimetric analysis of oxidation rate measurements for ultra-high temperature ceramics up to 1600° C
          Melia J. Miller-Oana, University of Arizona, USA