

NSMMS & CRASTE Agenda

NSMMS & CRASTE Plenary

Dr. Shery Welsh, Director, Air Force Office of Scientific Research

Mr. Stephen Jurczyk, Associate Administrator, NASA

Dr. Charles Camarda (Former Astronaut) President, Leading Edge Enterprises, LLC

NSMMS & CRASTE Tutorials

Organizers: Mr. Nickolas Demidovich, Federal Aviation Administration; Mr. Kenneth Knittel, Raytheon Missile Systems; Dr. Gerald Russell, Integration Innovation, Inc. & Mr. Timothy Stewart, Ultramet

Carbon/Carbon Composites – 101

Dr. Mark Jones, U.S. Navy

Flying at the Edge of Space and Beyond: The Opportunities and Challenges of Hypersonic Flight

Dr. Kevin Bowcutt, The Boeing Company

Technology Readiness Levels (TRL): Providing Clarity about Use and Limitations

Mr. Donald Williams, Northtech Enterprises

Pershing II Overview

Mr. Michael Fuller, Northrop Grumman Innovation Systems

EXTENDED ABSTRACT ONLY: Addressing Carbon-Carbon Manufacturing Challenges and Manufacturing of Carbon- Carbon Composites for Hypersonic Applications (MOC3HA) Program Update

Mr. Carter Johnson, U.S. Army CCDC Aviation and Missile Center

NSMMS

Additive Manufacturing for Space & Missile Materials

Lead Organizers: Dr. Amjad Almansour, NASA Glenn Research Center & Dr. Raymond Clinton, NASA Marshall Space Flight Center

Co-Organizers: Mr. Eric Becker, Air Force Research Laboratory; Ms. Kaia David, The Boeing Company & Dr. Suraj Rawal, Lockheed Martin Space Systems

Experiences in Additive Manufacturing Technologies for Aerospace Applications

Mr. David Waller, Ball Aerospace

Additive Manufacturing of PEEK and Fiber-Reinforced PEEK for NASA Applications and Custom Medical Devices

Dr. Roger Bagwell, Actuated Medical, Inc.

Metal Fused Filament Fabrication of Titanium Alloy for In Space Manufacturing

Mr. Curtis Hill, NASA Marshall Space Flight Center

Crystallographic Texture Evolution in Electron Beam Melted Ti-6Al-4V as a Function of Scan Strategy and Build Height

Mr. Alec Saville, Colorado School of Mines

Additive Manufacturing of Nb and Cu High Performance Propulsion Materials

Dr. Nicholas Cunningham, ATI

Ceramic On-Demand Extrusion (CODE) of Advanced Non-Oxide Ceramics

Mr. Austin Martin, Missouri University of Science and Technology

1st Place Student Winner: Selective Laser Sintering of Ultra-High-Temperature Ceramics and Other Refractory Non-Oxides

Mr. Adam Peters, The Johns Hopkins University

AM Enabled High Performance Refractory Alloys for Extreme Environments Applications

Dr. Youping Gao, Castheon, Inc.

Molybdenum – Titanium Alloy System Development for Directed Energy Deposition, A High Throughput Approach

Mr. Michael Niezgoda, University of Wisconsin Madison

Selective Laser Melting (SLM) Process and Post-Processing Heat Treatment Development of Monel K-500

Mr. Ryan Anderson, Quadrus Corporation

Additive Manufacturing of Multi-Functional Lattice Structure-Based Concepts for Thermal Protection System

3D Printing a Heat Shield for a Small Capsule

Mr. Stan Bouslog, NASA Johnson Space Center

Refinements of Metal Matrix Composite Prepreg for Ultrasonic Additive Manufacturing

Mr. Brandon Coates, Touchstone Research Laboratory

CRASTE

Advances in Ground System & Range Operations

Session Chair: Mr. Nickolas Demidovich, Federal Aviation Administration

Co-Chair: Mr. John Micol, NASA Langley Research Center

Weather and Natural Environmental Information Support for Hypersonic Vehicles

Dr. Gregory Wilson, EarthCast Technologies

Using Artificial Intelligence to Streamline Missile Typing in Ground Systems

Mr. David Motta, Northrop Grumman Systems Corporation

NSMMS

Development, Processing, & Testing of Advanced Materials

Lead Organizer: Mr. Eric Becker, Air Force Research Laboratory

Co-Organizers: Mr. Jimmy Allen, Dynetics; Dr. Amjad Almansour, NASA Glenn Research Center;

Ms. Kaia David, The Boeing Company; Prof. Greg Hilmas, Missouri University of Science and Technology; Dr. Garth Wilks, Air Force Research Laboratory; Dr. David Witkin, The Aerospace Corporation & Dr. Eric Wuchina, Naval Surface Warfare Center Carderock Division

<p>High-Char Yielding Resins as Precursors to Carbon-Carbon Composites Dr. Matt Laskoski, U.S. Naval Research Laboratory</p>
<p>Material Characterization of Silicon Nitride Fibers Fabricated by Rapid-Laser Chemical Vapor Deposition (R-LCVD) Dr. Shay Harrison, Free Form Fibers</p>
<p>Hybrid UHTCs for Re-Entry Vehicle Technology Demonstration Dr. Derek King, UES, Inc.</p>
<p>High and Ultra-High Temperature Laser-Printed Fibers: Results to Date and Benchmarking against Legacy Silicon Carbide Fibers Dr. Joseph Pegna, Free Form Fibers</p>
<p>Reinforced Zirconium Carbide Ceramic Composites for High-Temperature Environments Dr. Boris Dyatkin, U.S. Naval Research Laboratory</p>
<p>Observations and Conclusions Regarding Ultra-Refractory Material Performance from LHMEI Testing at Flux Levels up to 1000 W/cm² Mr. James Gorman, Exothermics, Inc.</p>
<p>Compatibility of High Entropy Borides and Refractory High Entropy Alloys Mr. Alec Murchie, Missouri University of Science and Technology</p>
<p>Effect of Steam on the Performance of 2700°F EBC-CMC System Dr. Amjad Almansour, NASA Glenn Research Center</p>
<p>Fiber Interface Coating Evaluation System II Dr. John Steinbeck, Physical Sciences, Inc.</p>
<p>2nd Place Student Winner POSTER: Flexure Strength of Fusion Welds in the SiC-ZrB₂-ZrC System Mr. Jecce Jarman, Missouri University of Science and Technology</p>
<p>POSTER: Damage Tolerance: Into the GigaWatt /cm² Regime with Hybrid Ceramics Dr. Duane Simonson, Research Support Instruments, Inc.</p>
<p>CRASTE Emerging Propulsion Systems Session Chair: Mr. Cory Gainus, Air Force Research Laboratory Co-Chair: Mr. Anthony Brinkley, Integration Innovation, Inc.</p>
<p>Test Campaign Overview of an Additively Manufactured Modular Liquid Oxygen/Liquid Methane Thruster Mr. Iddrisu Seidu, Air Force Research Laboratory</p>
<p>Review of Materials Behavior in Air-Breathing Rotating Detonation Engines Dr. Garth Wilks, Air Force Research Laboratory</p>
<p>Endurance Testing in a Rotating Detonation Engine: Motivation, Methods, and Maturation Dr. Christopher Stevens, Innovative Scientific Solutions, Inc.</p>
<p>Investigation and Testing of High-Temperature Materials for Air-Breathing RDE Mr. William Erwin, Plasma Processes, LLC</p>

Evaluation of CMCs for Rotating Detonation Engine Dr. Frederick Lauten, Physical Sciences, Inc.
POSTER: PVD Coatings of Surrogate Fuels for Cermet Nuclear Thermal Propulsion Mr. Jonathan Johnson, University of Alabama
NSMMS Ground & Flight Test Methodologies Lead Organizer: Dr. Joseph Sheeley, PERIKIN Enterprises Co-Organizers: Mr. M. Carter Johnson, U.S. Army Combat Capabilities Development Command Aviation & Missile Center; Dr. Gerald Russell, Integration Innovation, Inc. & Mr. Andrew Swanson, Air Force Research Laboratory
Mach 18 Capability Upgrade at AEDC's Hypervelocity Wind Tunnel No. 9 Mr. Parth Kathrotiya, National Aerospace Solutions, LLC
Mach 7 Capability Reactivation Efforts at AEDC's Tunnel 9 Facility in Support of Critical Missile Defense Mr. Nicholas Fredrick, National Aerospace Solutions, LLC
Progress on the Improved Rain Erosion Test Capability at the Holloman High Speed Test Track (HHSTT) Mr. Bryan Sinkovec, United States Air Force
HIFLIER-1 Flight Experiment Payload Design and Manufacturing Overview Mr. Michael Kurtz, GoHypersonic, Inc.
HIFLIER-1 Flight Experiment Instrumentation Package for Investigation of Second Mode Transition in Hypersonic Boundary Layers Dr. Adam Culler, GoHypersonic, Inc.
Thermal Mechanical Loading of Composite Hypersonic Vehicle Structures Mr. Kyle Adkins, Air Force Research Laboratory
A Compact, Low Cost Hypersonic Materials Testbed for Testing and Validating Thermal Protection System Materials and Associated Microphysics Models Dr. David Oakes, Physical Sciences, Inc.
POSTER: HySTRy – Hypersonic Structures Testing Repository Mr. Jonathan Boston, Air Force Research Laboratory
POSTER: LEEF AFRL's Leading Edge Experimentation Fixture Capt. Steffan Wilcox, Air Force Research Laboratory
NSMMS & CRASTE High Altitude/Sub-Orbital Experiments & Capabilities Session Chair: Mr. Zachary Tolley, Blue Origin, LLC Co-Chair: Mr. Nickolas Demidovich, Federal Aviation Administration
A Decade of Technology Maturation through NASA's Flight Opportunities Program Mr. John Kelly, NASA Armstrong Flight Research Center

Simulation of Heavy Launch Vehicle for Global Point to Point Transport

Mr. Alok Virkar, Sierra Lobo, Inc.

NSMMS

Hypersonics

Lead Organizer: Mr. Craig Ohlhorst, NASA Langley Research Center

Co-Organizers: Mr. Curtis Martin, Naval Surface Warfare Center Carderock Division; Mr. Tod Palm, Northrop Grumman Aerospace Systems; Mr. Miklos Petervary, The Boeing Company; Dr. Brian Sullivan, Materials Research & Design, Inc. & Mr. Brian Zuchowski, Lockheed Martin Aeronautics Company

Hypersonic Boost-Glide Materials Requirements: It's Not as Hard as We Thought

Dr. Jesse Maxwell, U.S. Naval Research Laboratory

X-60A Program Update

Mr. Barry Hellman, Air Force Research Laboratory

Conceptual Design of an X-60A Payload Incorporating Hypersonic Flight Test Experiments

Mr. Neal Novotny, The University of Dayton Research Institute

An Inverse Approach to Trajectory Optimization with Material Constraints

Dr. Michael Brupbacher, The Johns Hopkins University Applied Physics Laboratory

Low-Entropy Lifting and Control Surfaces for Hypersonic and Atmospheric Entry Vehicles

Dr. Jesse Maxwell, U.S. Naval Research Laboratory

Design, Analysis, and Fabrication of an Elevon Test Article for the AFRL Flight Research Vehicle

Dr. Brett Hauber, The University of Dayton Research Institute

Hybrid Ceramic-Metal Control Fin for Hypervelocity Projectiles

Mr. Craig Iwano, Materials Research & Design, Inc.

Evaluation of Design Enhancements to Limit Convective Heat Transfer in High Temperature Seals

Mr. Shawn Taylor, The University of Toledo

Evaluation of Conductive and Radiant Heat Transfer in Thermal Barriers Containing Aerogel Composites

Mr. Joshua Finkbeiner, NASA Glenn Research Center

3rd Place Student Winner: Experimental Analysis of Gas-Surface Interactions with Ablating Material

Maj Robert MacDermott, Air Force Institute of Technology

Screening Test Results of Additively Manufactured, Continuous Fiber Reinforced Carbon/Carbon

Mr. Timothy Dominick, Northrop Grumman Corporation

C/C Processing with Inherently High Char Yield Resins

Dr. Michael Rauscher, Cornerstone Research Group, Inc.

Lyocell as Rayon Replacement for Hypersonic Applications

Ms. Mary Ebbert, Materials Research & Design, Inc.

Life Prediction and Testing of Oxide Ceramic Matrix Composites

Dr. Marlana Goldsmith, Boeing Research & Technology

Advanced Manufacturing of Oxide Ceramic Composites

Ms. Mary Litwinski, Boeing Research & Technology

EXTENDED ABSTRACT ONLY: Modeling and Analysis Approaches for Designing Advanced Hypersonic Leading Edges

Dr. Arun Bhattacharya, Northrop Grumman Corporation

EXTENDED ABSTRACT ONLY: Near-Net Shape Additive Manufactured Inlet for High Speed Missile

Dr. Daniel Driemeyer, Boeing Research & Technology

CRASTE

Innovative Test Methodologies & Platforms

Session Chairs: Mr. Jeramie Broadway, NASA Marshall Space Flight Center

Co-Chair: Mr. Nickolas Demidovich, Federal Aviation Administration

Hypersonic Research Vehicle (HRV)

Dr. Ajay Kothari, Astrox Corporation

Solid Rocket Motor Air Flow Test Equipment Technology Model

Mr. Roger Herdy, CFD Research Corporation

Design of an Inexpensive Black Box for Commercial Orbital and Suborbital Vehicles

Mr. Dale Amon, Immortal Data, Inc.

A Modular Sensor Suite for Propulsion Testing

Dr. Yudaya Sivathanu, En'Urga, Inc.

Integrated Vehicle Health Management (IVHM) & Integrated Systems Health Monitoring (ISHM) Workshop

Workshop Chairs: Mr. Derek DeVries, Northrop Grumman Innovation Systems & Mr. James Larkin, Aerojet Rocketdyne

Advancements in the Development of a Fiber Optic Non-Invasive Sensing System for Lifecycle Management (NIEL)

Dr. Quinn McAllister, Applied Composites

Real-Time Impact Damage Assessment for Space Structures

Dr. Amrita Kumar, Acellent Technologies, Inc.

CMC Structural Integrity and Property Monitoring using Ultrasound NDE

Dr. Ming Chen, Air Force Research Laboratory

Challenges with Integrated Vehicle Health Management Systems

Mr. Derek DeVries, Northrop Grumman Innovation Systems

Enhanced Physics Based Prognosis and Inspection for Ceramic Matrix Composites (EPPIC)

Dr. George Jefferson, Air Force Research Laboratory

NSMMS

Missiles & Missile Defense

Lead Organizer: Mr. Aaron Cossey, Missile Defense Agency

Co-Organizers: Mr. Jason Calvert, U.S. Army Space and Missile Defense Command;

Dr. Douglas Deason, Deason Research, LLC; Mr. M. Carter Johnson, U.S. Army Combat Capabilities Development Command Aviation & Missile Center; Mr. Paul Marchol, Aerojet Rocketdyne;

Mr. Curtis Martin, Naval Surface Warfare Center Carderock Division; & Dr. Gerald Russell, Integration Innovation, Inc.

Advanced Materials Overview

Mr. Mark Glenn, Missile Defense Agency

Results from 2019 Thermal Testing for the Composites and Advanced Materials (CAM) Program

Mr. Shawn Whitehead, Integration Innovation, Inc.

Advancements and Updates Pertaining to High Speed Flight Performance in Weather

Mr. Brandon Osborne, Integration Innovation, Inc.

Development of Unstructured Grid Capabilities and Validation Datasets for the HEAT Framework

Dr. Conrad Patton, CFD Research Corporation

Development of Transient Decomposition Method (TDM) for Thermal Protection Materials

Mr. Zach Robertshaw, Integration Innovation, Inc.

Status of the Selective Laser Melting of W-Re Alloys

Mr. Stephen Cooke, Quadrus Corporation

High Performance/High Temperature Actuation Mechanisms

Dr. Safakcan Tuncdemir, QorTek, Inc.

Multi-Functional Lightning, Thermal, and Radiation Shielding Composite Structures

Mr. Dwayne Morgan, Touchstone Research Laboratory

Mechanical and Thermal Characterization of a Woven AS4 Fiber 3DCC Composite

Mr. Tanner Cauthen, Southern Research

NSMMS

Mission Operations & Experiments in Space

Lead Organizer: Mr. Michael Fuller, Northrop Grumman Innovation Systems

Co-Organizers: Dr. Derek Doyle, Air Force Research Laboratory; Mr. Michael Renbarger, Ball Aerospace; Mr. James Tucker, Southern Research & Mr. John Vasquez, U.S. Naval Research Laboratory

Multi-Environment MLI: Lightweight Supported Vacuum Shells

Mr. Gary Mills, Ball Aerospace

Carbon Nanotube Based Optical Black Coatings for Optical and Infrared Applications

Mr. David Carnahan, NanoLab, Inc.

Metrology for Thermal Stability Testing of a Starshade Petal

Mr. James Tucker, Southern Research

Six Month Launch/Return Cadence Using the MISSE Orbital Test Platform

Mr. Mark Shumbera, Alpha Space Test & Research Alliance

POSTER: Hybridized Boron-Carbon Fiber Reinforced Composite Materials

Dr. James Marzik, Specialty Materials, Inc.

CRASTE

Reducing Cost, Increasing Safety, & Improving Reliability

Session Chair: Mr. Barry Hellman, Air Force Research Laboratory

Co-Chair: Mr. Robert Seibold, The Aerospace Corporation

Safe and Reliable Li-Ion Polymer Intelli-Pack® Battery for Aerospace Platforms

Mr. Edmund Burke, Space Information Labs

CRASTE

Responsive Access for Pico/Nano/Small Payloads

Session Chair: Mr. Robert Seibold, The Aerospace Corporation

Co-Chair: Mr. Zachary Tolley, Blue Origin, LLC

Comparing Government And Commercial Launch Paradigms – Past, Present and Future

Mr. Juan Gutierrez, Sierra Lobo, Inc.

A Glance at 3 Rapid Launch Scenarios for Small Constellation Constitution with Small Satellites

Mr. Juan Gutierrez, Sierra Lobo, Inc.

Not Another Orbital Transfer Vehicle Trade Study! An Evaluation of Multiple Propulsion Types for Large Payload Transfer

Mr. Ethan Sichler, Air Force Research Laboratory

NSMMS & CRASTE

Space Access & Propulsion

Lead Organizer: Mr. Anthony Brinkley, Integration Innovation, Inc.

Co-Organizers: Mr. Alan Brown, Aerojet Rocketdyne; Mr. Timothy McKechnie, Plasma Processes, LLC;
Mr. Timothy Stewart, Ultramet & Mr. Robert Taylor, Air Force Research Laboratory

SpinLaunch: Revolutionizing Access to Space

Mr. Steve Hobart, SpinLaunch

Nitrous Oxide – Propane Rocket Engine

Mr. Roger Herdy, CFD Research Corporation

HydroCarbon Boost Full Scale Oxygen-Rich Preburner Test Campaign Overview

Mr. Alan Sutton, Air Force Research Laboratory

Combustion Stability Characteristics of the Hydrocarbon Boost Oxygen Rich Preburner

Dr. Robert Jensen, Sierra Lobo, Inc.

Development of SiC Foam Igniter for Mars RCS Thruster

Mr. Phu Quach, Ultramet

AF-M315E Monopropellant Cubesat Propulsion System

Dr. Art Fortini, Ultramet

A Virtual Railroad to Moon and Mars

Dr. Ajay Kothari, Astrox Corporation