

The background of the entire poster is a vibrant, multi-colored space scene. It features a large, detailed view of the Earth's horizon in the upper left, a bright, glowing nebula or galaxy in the upper right, and a rocket launch with a massive plume of fire and smoke at the bottom. The overall color palette is dominated by purples, blues, and oranges, creating a sense of cosmic wonder and technological advancement.

# NSMMS

NATIONAL SPACE & MISSILE MATERIALS SYMPOSIUM

# CRASTE

COMMERCIAL AND GOVERNMENT RESPONSIVE ACCESS  
TO SPACE TECHNOLOGY EXCHANGE

# CALL FOR ABSTRACTS

INDIAN WELLS, CA  
26-29 JUNE 2017

# NSMMS & CRASTE

## Join Us

You are invited to participate in both the 2017 National Space & Missile Materials Symposium (NSMMS) and the 2017 Commercial and Government Responsive Access to Space Technology Exchange (CRASTE) from 26 -29 June, 2017 in Indian Wells, California at the Renaissance Indian Wells Resort & Spa. These co-located conferences continue their outstanding legacy in bringing together technologists, users, and decision makers from across the nation. Key discussion involves key technology issues related to space, missile, hypersonic systems, and a variety of ground-breaking commercial space topics necessary for our Country's defense and research and development pursuits.

The NSMMS focuses on the materials industry's needs and most recent advances to enable new capabilities for challenges associated with new and future space and missile systems. A special focus is given to advanced materials technology development which is crucial to improve performance and reliability of both defense and commercial systems.

CRASTE focuses on matching system integrators with subsystem technology providers to facilitate new responsive space access capabilities. Special focus is given to the integration of emerging technologies and emerging space access architectures to satisfy new and existing markets.

The 2017 forum will have a joint senior level plenary session, a variety of technical sessions covering ground-breaking research and technology, tutorials and workshops, a poster session, an exhibit show, a small business forum, and multiple networking events.

For the first time, NSMMS & CRASTE attendees will have unlimited access to all the technical sessions at both events. These events share significant support from DoD, DoE, FAA, and NASA with an effort to promote the commercial and government space and missile and space launch communities. Each year, our industry and academia partners help ensure that we focus on the latest advancements and challenges affecting the industry. We invite you to submit an abstract that discusses the leading edge technology or research your organization is working on, as well as engage your organization through exhibiting, sponsoring, or participating in our outreach programs.

## Thank you to our NSMMS & CRASTE Supporters!

- Aerojet Rocketdyne
- The Aerospace Corporation
- Air Force Research Laboratory
- Army Aviation & Missile Research Development & Engineering Center
- Army Space & Missile Defense Command
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- Plasma Processes, LLC
- Raytheon Missile Systems
- Space Dynamics Laboratory
- Southern Research
- Ultramet
- The University of Texas at Austin
- Zero Point Frontiers Corporation

# NSMMS & CRASTE

## NSMMS TOPICS

### **NSMMS Topic 1: Additive Manufacturing (AM) for Space and Missile Materials**

This topic area focuses on recent developments in additive manufacturing methods and production of materials for diverse aerospace applications including structural, thermal management, and propulsion components. New materials (monolithic, graded, composites, or coatings) development for space applications and methodology of that development will also be addressed. Additional areas of interest under this topic include the non-destructive inspection, post-processing heat treatments, residual stresses, in-situ monitoring, integrated computational and materials engineering tools, and database development and processes for assessment. This topic area also includes the results of design and development for AM processed components and the status of verification, validation, and part qualification.

### **NSMMS Topic 2: Emerging Materials and Novel Processing Technologies**

This topic area addresses emerging materials innovations at lower TRL level (1-3), encompassing both materials science and process development. Topic areas include next generation materials with improved properties, novel materials processing, and computational materials science.

*Next Generation Materials* – This area focuses on the development of new materials that provide unique combinations of properties and/or demonstrate property retention in extreme environments. This includes ceramics/UHTCs, metal alloys, composites, innovative thermal protection materials, sensor & nanomaterials.

*Novel Materials Processing* – This area focuses on novel materials processing methods to improve material properties. Special focus areas include flash sintering and spark plasma sintering (SPS).

*Computational Materials Science* – This area focuses on novel approaches to computationally driven materials design, verification of predicted structure/property relationships models to accelerate materials development, and lower materials development costs.

### **NSMMS Topic 3: Hypersonics**

This topic area addresses materials and structural concepts that support single use or reusable hypersonic flight and responsive strike systems. Additional topics include, but are not limited to affordable & high performance: aero-structures, propulsion, tanks, durable and rapid turnaround thermal protection systems, integrated thermal management, hot structures, leading edges, seals, Integrated System Health Monitoring (ISHM), the use of Integrated Computational Materials Engineering (ICME), ground test methods, operations, and test facilities. Abstracts on materials and structures are sought that are TRL 4 and above, are planned for flight, have recently flown, or are in trade studies that are enabling affordable hypersonic flight.

### **NSMMS Topic 4: Missiles & Missile Defense**

This topic area includes materials and material processes that support missile defense, strategic systems, tactical missiles, high energy kinetic projectiles, and re-entry systems for military applications. Abstract topics may include missile material/component performance, properties, analysis, material producibility, affordability, corrosion prevention, and sustainability; ground- and flight-test materials evaluations; weather encounter; and material manufacturing advances and innovative techniques. Program and system overviews with pertinent materials issues and updates related to current missile programs are also of interest. Focus areas include development and ground/flight testing of missile thermal protection systems, radomes, infrared windows and domes, structural insulators, axial rocket motors and propulsion control system materials, material technologies for novel propulsion systems (excluding propellants), aging and surveillance, and technologies for insensitive munitions.

# NSMMS & CRASTE

## NSMMS TOPICS

### **NSMMS Topic 5: Mission Operations and Experiments in Space**

This topic area addresses key materials technologies, requirements, novel designs, or materials innovations for current and future space missions/operations, and planetary exploration for commercial or government customers focusing on materials and environmental effects on materials in space or simulation on the ground. Space operation technology interests include communications, optics, optical benches, solar arrays, sensors, and other payload materials. Space exploration technologies for atmospheric entry to landing and surface operation including thermal protection systems will also be addressed. Additional areas of interest include the tools and processes for assessment including computational modeling, ground testing, and actual space environment experimentation (including results from Materials on International Space Station Experiments (MISSE)). This topic area also includes environmental simulation chambers, radiation effects, and atomic oxygen effects.

### **NSMMS Topic 6: Space Access & Propulsion**

This topic area addresses space propulsion critical materials and processing technologies enabling access to space including single use or reusable crewed and robotic launch and orbital boost systems. Topics of interest include innovative structures, materials, processes, structures design, development, and manufacturing fabrication concepts for launch vehicle structures, propulsion systems, propellant tanks, engine systems, solid and liquid rocket boosters, tankage, and thermal management/protection systems.

## **Important Notices**

### **Two For One**

For the first time, all registrants for NSMMS & CRASTE will have access to both conference's technical sessions. This means that no matter what conference you submit your abstract for, both conference's attendees can listen in on your presentation.

### **Travel Restrictions & Approval**

Good News! As many of you know, the conference restrictions on government attendance have been very limiting over the past couple of years. The Secretary of Defense has recognized that the regulations on government attendance have severely restricted the flow of information and blocked innovation. New guidance on military and government attendance at conferences is being implemented to relieve this issue and make it easier for you to collaborate and meet with your peers at conferences and symposia. Each service may choose how they implement this new guidance by the Secretary of Defense, and may choose to be more restrictive than he is directing. You should check with your service officials to determine how this affects you.

For those working for government agencies, you are encouraged to submit your travel requests now. Though travel restrictions for many government agencies are beginning to loosen, some still require many months advance notice with conference travel. Because of this, we encourage you to get your paperwork submitted ASAP and contact us if you need any additional information or justification.

### **Event Information Security**

This Symposium is restricted to U.S. PERSONS ONLY, is ITAR Restricted in accordance with DoD directive 5230.25 under the provisions of the Arms Export Control Act, and contains Military Critical data. This Symposium is not open to the general public.

# NSMMS & CRASTE

## CRASTE TOPICS

### **CRASTE Topic 1: Novel Testbed Capabilities for Environmental Testing Platforms for Larger Systems**

This topic covers the advancements in cubesat and smallsat systems and sub-systems. It also includes the test and demonstration capabilities of the cubesat/smallsat platform to improve technology readiness levels (TRLs) of systems and components that may be useful to larger satellites, launch vehicles, and upper stages such as guidance, communication, and propulsion in relevant environments. We encourage abstracts that look at progress in using this method of test and demonstration to reduce risk and cost for existing small, medium, and heavy lift systems and next generation responsive access to space and sub-orbital systems. (Note: medium to high thrust propulsion systems are covered in CRASTE – Emerging Propulsion Systems topic). Propulsion topics here include, but are not limited to, test and demonstration of low-thrust propulsion systems for attitude control systems or small upper stages, propulsion system components such as valves and propellant management devices and sensors, and scalable technology to support medium- to high-thrust propulsion systems such as new propellants, new propellant combinations, and new engine designs.

### **CRASTE Topic 2: Responsive Access for Pico/Nano/Small Payloads**

This topic includes existing and emerging platforms for delivering small payloads and experiments into their desired location (high altitude, sub-orbital, or orbital environments). This would include concepts for novel use of vehicles such as a flying testbed. We are seeking abstracts with a focus on near term capabilities in development for delivering payloads up to 1000 lbs into the desired environment for less than \$5M per launch. This topic area includes requirements and understanding of projected payloads, orbits, and capabilities of emerging systems. Technical challenges and time lines should be addressed where practical. This topic area also includes government practices, programs, and technologies which potentially benefit the emerging sub-orbital and small launch industry.

### **CRASTE Topic 3: Advances in Range Operations and Ground System Development**

This topic area focuses on the ground segment and how to reduce costs while improving operability. We encourage abstracts that discuss advanced and/or low-cost range concepts; data collection technologies; air & launch traffic control; clean pad concepts; vertical versus horizontal integration; innovative ground test methods; and other technologies that will reduce cost per launch (or re-entry), turn-around time, and overall life cycle costs. This topic includes FAA commercial launch license and (experimental) permit process issues. Abstracts on range utilization of autonomy/automation and/or artificial intelligence to streamline and reduce ground operation costs or timelines are desired. Finally, we are seeking abstracts that discuss the developments/initiatives to minimize impact of launch (orbital and sub-orbital) and re-entry on other National Airspace (NAS) users.

### **CRASTE Topic 4: Reducing Cost and Increasing Safety**

This topic area will cover concepts and/or progress in developing low cost (or lower cost) subsystems, systems or architectures that will help increase safety and/or flight rate of launch (orbital and sub-orbital), and future “commercial aircraft-like” re-entry. Topics include, but are not limited to, non-toxic propellants/monopropellants, minimization of launch and re-entry noise, improved noise modeling of launch and re-entry operations, subsystem and vehicle integrated health management systems, and associated sensors for severe environments. This topic includes increased reliability and public safety, as well as safety of crew and other occupants for manned vehicles.

# NSMMS & CRASTE

## CRASTE TOPICS

### **CRASTE Topic 5: High Altitude/Sub-Orbital Experiments**

This topic area addresses lessons learned and information gathered from recent flight test experiments on high-altitude balloons and sub-orbital rockets. This includes both commercial and government platforms. Lessons learned may include test conduct, safety, and mission performance.

### **CRASTE Topic 6: Emerging Propulsion Systems**

This topic area addresses industry and government propulsion development programs that can support future responsive space access needs. The topic includes traditional rocket engines and emerging technologies to develop lower cost propulsion solutions for medium (1k - 10k lb) and large (10k+ lb) orbital payloads. Of interest are rocket engines and propulsion technologies that can be used in support of next generation of Evolved Expendable Launch Vehicles (EELV), reusable boost system architectures, low-cost expendable engines (experimental demonstrators and emerging operational systems), and propellant development. Recommended technology roadmaps and demonstrations are also encouraged.

### **Abstracts are also Welcome for These NSMMS & CRASTE Topics**

- Propulsion, Orbital Maneuvering Systems, and Attitude Control Systems
- Avionics, Communications, and Flight Control
- Entry, Descent, and Recovery Systems
- Vehicle (Internal) Energy & Thermal Management Systems
- Life Support and Safety Systems
- Ground Support, Operations, and Processing Equipment
- Advanced Vehicle Concept Technologies
- Integrated Flight Demonstrators
- Responsive Ground Operation and Range Technologies
- Commercial Space Technologies & Payloads (Universities & FFRDCs Funded by FAA)
- Non-Toxic and Green Propellants (NOFBX, HAN, SSC, H2O2, N2O Based Systems)
- Reusable Technologies
- Light Weight Expendables
- Innovative Test Methodologies

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

Please consider submitting an abstract for inclusion in this workshop. The intent of this workshop is to identify and examine two of the key steps for optimizing an IVHM/ISHM system for Space applications. Processes by which safety, reliability, performance, affordability and reusability requirements are established, and how their gaps are identified and allocated will be discussed. Additionally, benefits of various technologies will be quantified to provide visibility into how such approaches are used in closing requirement gaps, which enable a specific IVHM/ISHM system to be optimized.

A rigorous process enables IVHM/ISHM customers and designers to establish a requirements gap baseline for the inherent design (without IVHM/ISHM), and a pathway to ultimately meet the sometimes-conflicting requirements. A variety of processes will be explored in this workshop, ranging from a historical probability-based approach to a detailed physics-based tactic.

IVHM/ISHM technology benefits are strongly dependent upon their application (expendable versus reusable, human-rated versus unmanned systems, etc.). Benefits will be quantified in terms of requirement gap closure capability, where IVHM/ISHM system optimization is achieved via selection of the best benefits-to-cost ratio.

Given that CRASTE Topic 3 focuses on reducing cost and increasing safety (and includes IVHM), and NSMMS Topic 3 addresses Hypersonics (including ISHM), this joint workshop will be a cross-cutting activity of interest to both communities.

# NSMMS & CRASTE

## Other Ways to Engage

### Become a Sponsor

These events are in large part made possible by industry sponsorships. Why sponsor? ....prominent organizational recognition...position yourself for the future....involve your organization in influencing the direction of the industry, and many other valuable return on investment reasons. A variety of sponsorship packages are available for all budgets. For more information, contact Michelle Williams at 937-554-4632, [mkw@blue52productions.com](mailto:mkw@blue52productions.com) or visit our website at <https://www.usasymposium.com/space/sponsorship.php>. **Thank you to these industry leaders who have already joined the NSMMS & CRASTE sponsorship team for 2017!**



Solving the world's  
hardest problems.



### Exhibit

Last year was a sold out show. Sign up now to reserve your space for this great networking & marketing opportunity. To register for an exhibit, visit <https://www.usasymposium.com/space/exhibitor.php>.

### Small Business Forum Participation

One of the many noteworthy elements of the NSMMS & CRASTE events is the Small Business Forum and numerous opportunities to network. We invite you to engage and maximize your opportunities to team with other companies and engage with the government. The goal of this forum is to facilitate the interaction of small businesses and universities with larger "prime" contractors based on similar interests that relate to specific materials/performance metrics relevant to NASA and the Department of Defense. Additionally, we will provide you with connections and resources within the government SBIR agencies to start your interaction with or assist you along the path of meaningful interactions with a variety of the SBIR offices. We are confident you will broaden your contacts with regard to technology needs and transfer in order to foster future communication, innovation, and partnerships. The participating primes and SBIR agencies will be announced on the website in the coming months. Small businesses and universities may sign up for one-on-one appointments starting in early February. For more information, please visit <https://www.usasymposium.com/space/sbf.php>.

# NSMMS & CRASTE

## Abstract Submission Process

**Abstract Due Date: 6 January 2017**

We look forward to receiving your abstracts for the 2017 NSMMS & CRASTE events via online submission at <https://www.usasymposium.com/space/cfa.php>. Abstracts should be unclassified and may include ITAR or Military Critical information, if they are PASSWORD PROTECTED. Acceptable distribution levels for abstracts include A or C ONLY. Though abstract submission is done online, passwords for the password protected documents should be emailed to Sherry Johnson at [sjohnson@blue52productions.com](mailto:sjohnson@blue52productions.com). For information on how to password protect your abstract, visit <http://www.usasymposium.com/space/cfa.php>. Nonrestricted (Distribution A) documents do not need to be password protected. For questions concerning submission of your abstract, please contact Sherry Johnson at [sjohnson@blue52productions.com](mailto:sjohnson@blue52productions.com), 937-554-4671. Be sure to include the title of your abstract in the body of the submission (the title does not count against the 300 word count.) All abstracts should fall into one or more of the described topics on the previous pages.

In early February 2017, you will be contacted regarding the status of your acceptance. Please note that selected abstract titles will be included on the website and in the program which is freely distributed. Therefore, abstract titles should be cleared for public release.

**PLEASE DO NOT WAIT FOR NOTIFICATION ACCEPTANCE TO SUBMIT A TRAVEL APPROVAL REQUEST WITHIN YOUR ORGANIZATION. START THAT PROCESS NOW.**

Final presentations will be due 26 May 2017. Final presentations and papers should not contain proprietary information and may not be more restrictive than Distribution C (Distribution authorized to U.S. Government Agencies and their contractors). Please note, presentation of an abstract does not waive any applicable registration fees.

### Poster Session Participation

Consider submitting multiple abstracts to take advantage of your time at the event. Even if you give an oral presentation, you can increase your exposure by presenting a poster as well. The poster session is an important and alternative way to present the results of your research and technology and in some cases is a more effective way to present your material. Poster presentations will be available to attendees Monday evening through Wednesday evening in the joint NSMMS & CRASTE exhibit hall. Extra emphasis will be placed on posters during the two receptions on Monday and Wednesday when the authors are required to be present.