NSMMS: Additive Manufacturing for Space & Missile Materials

This topic area focuses on recent developments in additive manufacturing (AM) methods and production of materials for diverse aerospace applications including structural, thermal management, and propulsion components. Some areas of emphasis include:

- Correlation of processing parameters versus materials properties and performance,
- Refractory metals, ceramic composites, and ultra high temperature composites (UHTCs),
- Post processing heat treatments, Residual stresses, In-situ monitoring,
- Integrated computational and materials engineering tools,
- Development methodology of new AM materials (monolithic, graded, composites, or coatings),
- Results of design and development of AM processed components,
- Database development and processes for assessment,
- Non-destructive inspection,
- Verification/certification,
- Part/process qualification
- Printed electronics, and
- In space manufacturing specific topics:
  - Fiber reinforced polymers
  - Recycling of materials for feedstock generation, and
  - Metals updates.

CRASTE: Advances in Ground Systems & Range Operations

This session focuses on the ground segment and how to reduce costs while improving operability. The session will cover 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. The session covers FAA commercial launch license and (experimental) permit process issues; and range utilization of autonomy/automation and/or artificial intelligence to streamline and reduce ground operation costs or timelines are desired, including space object tracking. Finally, the session will cover the developments/initiatives to minimize impact of launch (orbital and sub-orbital) and re-entry on other National Airspace (NAS) users.

NSMMS: Development, Processing & Testing of Advanced Materials

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 integrated computational materials engineering.

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 multifunctional materials, ceramics, carbon-carbon, UHTCs,
composites, high temperature fiber development, innovative thermal protection materials (ablative and non-ablative), sensor, and nanomaterials.

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

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

CRASTE: Emerging Propulsion Systems

This session addresses industry and government propulsion development programs that can support future responsive space access needs. Topics include:

- Traditional rocket engines and emerging technologies to develop lower cost propulsion solutions for small (<1k lb), medium (1k-10k lb), and large (10k+ lb) orbital payloads,
- Rocket engines and propulsion technologies that can be used in support of next generation National Security Space Launch (NSSL),
- Reusable boost system architectures,
- Low-cost expendable engines (experimental demonstrators and emerging operational systems),
- Emerging nuclear technologies, and
- Pressure Gain Combustion.

NSMMS: Ground & Flight Test Methodologies

This session series focuses on the development and utilization of ground and flight test capabilities to support system development and model validation. The renewed interest in hypersonics, as well as space access has resulted in the identification of gaps in the available test and evaluation infrastructure, as well as workforce attrition. The Aerospace Community has recognized these gaps and invested funding to improve the test capability and capacity supporting flight and space system development. These investments are focused on risk reduction to ensure that technology maturation can be adequately accomplished prior to operational fielding. Topics covered in this session include:

- Test and evaluation infrastructure modernization and enhancement within DoD, Industry, and Academia,
- Simulation of environments to address aerodynamics, aerothermodynamics, combined thermostructural, boundary layer transition, and weather encounter, and
- Ground and flight test and evaluation methodologies for material and component development and modeling and simulation validation.

NSMMS & CRASTE: High Altitude/Sub-Orbital Experiments & Capabilities

This session addresses lessons learned and information gathered from recent flight test
experiments on high-altitude balloons, sub-orbital rockets, and other relevant platforms. Topics include:

- Overview of commercial or government high altitude/sub-orbital platforms,
- Lessons learned on test conduct, safety, and mission performance, and
- Capabilities for future test and upgrades.

**NSMMS: Hypersonics**

This topic addresses hypersonic systems and requirements, component testing, leading edges, acreage TPS and hot structures, control surfaces, and windows/apertures.

**CRASTE: Innovative Test Methodologies and Platforms**

This session covers innovative test methodologies and platforms to mature small-sat and vehicle technologies in flight. Emphasis is on the test and demonstration capabilities of test platforms to improve technology readiness levels (TRLs) of systems and components that may be useful to future satellites, launch vehicles, and upper stages such as guidance, communication, and propulsion in relevant environment. Topics include:

- Test platform descriptions,
- Payloads preparation and integration methods,
- Results from previous flight tests,
- Payload recovery methods, and
- Approaches to increase flight cadence.

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

This topic area will address current use and perspectives of IVHM/ISHM as an integral part of space systems. Applications will include, but are not limited to, solid motor, liquid rocket, hypersonic, nuclear, and electric propulsion. This topic area is seeking abstracts which address one of the following IVHM/ISHM topics:

- Additive manufacturing technologies for enabling IVHM/ISHM,
- Business cases for IVHM/ISHM,
- Recent IVHM/ISHM application success stories,
- Sensor suite optimization for enabling IVHM/ISHM, and
- Solutions for closing IVHM/ISHM requirement gaps.

**NSMMS: Missiles & Missile Defense**

The topic area is focused on addressing material technology development and transition for Missiles and Missile Defense applications, including the new area of interest in hypersonic defense:

- Characterization of material/component performance,
2020 NSMMS & CRASTE Session Descriptions

- Material properties, analysis, and producibility;
- Ground and flight test materials evaluations;
- Material manufacturing advancements;
- Innovative techniques, and
- Program and system overviews with pertinent materials issues and updates related to current missile programs.

NSMMS: Mission Operations & Experiments in Space

This topic area addresses materials technologies, requirements, novel designs, or materials innovations for current and future space missions/operations and planetary exploration including:

- In-space assembly of telescopes and satellites,
- Environmental effects and sensing: radiation, atomic oxygen (MISSE), venting, and high and cryogenic temperature testing,
- Contamination concerns: outgassing, photopolymerization, effects on thermal and optical properties,
- New developments in flight materials: nanomaterials, thermal protection systems, and satellite materials, stray light coatings, and
- Modeling of structural and thermal applications.

CRASTE: Reducing Cost, Increasing Safety, & Improving Reliability

This session covers concepts and 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. This session also includes increased reliability and public safety, as well as safety of crew and other occupants for manned vehicles.

CRASTE: Responsive Access for Pico/Nano/Small Payloads

This session includes existing and emerging platforms for delivering small payloads and experiments into their desired location (high altitude, sub-orbital, or orbital environments). Topics include:

- Near term capabilities in development for delivering payloads up to 1000 lbs into the desired environment for less than $5M per launch,
- Requirements and understanding of projected payloads, orbits, and capabilities of emerging systems including associated technical challenges and timelines, and
- Government practices, programs, and technologies which potentially benefit the emerging sub-orbital and small launch industry.

NSMMS & CRASTE: Space Access & Propulsion

This topic area addresses launch, satellite, and propulsion systems that improve space access. Areas that emphasize system level advancement, critical materials, and processing technologies are desired including single-use/reusable crewed or robotic launch/orbital
Of particular interest this year are commercial space development efforts applied to government requirements with a focus on modularity and agility. Additional topics of interest include innovative vehicle concepts and designs, structures and designs, materials and processes, and manufacturing fabrication concepts for:

- Launch vehicle and in-space propulsion system structures,
- Engine systems,
- Solid and liquid rocket boosters,
- Nuclear thermal/electric propulsion,
- Propellant tanks, and
- Thermal management/protection systems.