

HTSC

**HYPERSONIC TECHNOLOGY
& SYSTEMS CONFERENCE**

8 - 11 March 2021, Springfield, VA

CALL FOR ABSTRACTS

Abstract Due Date: 13 July 2020

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Approved for Public Release/Unlimited Distribution;
Case File Number 88ABW-2019-5806; 27 Nov 2019

Please Join Us!

We invite you to participate in the third annual Hypersonic Technology & Systems Conference (HTSC) which will take place at the National Geospatial-Intelligence Agency (NGA) Campus East (NCE) Conference Center in Springfield, VA, 8 - 11 March 2021

Sustained hypersonic flight within dense atmosphere has substantial utility. Advances in underlying technologies and integration into weapon systems offer the DoD significant enhancements in its ability to penetrate heavily defended areas and prosecute time-critical targets. Other nations are also actively pursuing these technologies; as such, defense against such systems is also of increased interest. The technologies required to enable the reliable use of hypersonic vehicles are multi-disciplinary. Some of these technologies that HTSC focuses on include:

- Aerodynamics
- Aerothermodynamics
- Detection and Tracking
- Navigation, Guidance and Control
- Propulsion Challenges (Air-Breathing & Rocket Boost)
- Sensors
- Power Systems
- Materials & Manufacturing
- Structures
- Mission Planning/C4ISR/Kill Chain
- Systems Engineering, Architecture & Platform Integration

HTSC's emphasis is on systems and applied technology. This conference highlights the nation's investments in systems integrated hypersonic technologies for both research and development and weapon platform integration for offense and defense. It brings together the best and brightest involved in the development and use of hypersonic technologies in a unique, limited-attendance forum which will facilitate knowledge sharing and collaboration opportunities.

HTSC RECEIVES TECHNICAL GUIDANCE FROM THE FOLLOWING ORGANIZATIONS:

Air Force Research Laboratory
Army Combat Capability Development Command Aviation & Missile Center
Army Rapid Capabilities and Critical Technologies Office
Arnold Engineering Development Complex
The Boeing Company
Deason Research, LLC
Defense Advanced Research Projects Agency
Georgia Tech Research Institute
Integration Innovation, Inc.
The Johns Hopkins University Applied Physics Laboratory
Lockheed Martin Corporation
Missile Defense Agency
MIT Lincoln Laboratory
NASA Langley Research Center
National Geospatial-Intelligence Agency
Naval Surface Warfare Center
Northrop Grumman
Office of Naval Research
Office of the Under Secretary for Defense for Research & Engineering
Raytheon Missile Systems

JOIN OUR SPONSORSHIP TEAM

HTSC is made possible in large part, by industry and academia sponsorships. Join the team! For more information, contact Erin Foster at efoster@blue52productions.com or visit <https://www.usasymposium.com/Hypersonics/sponsorship.php>.

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KEY DATES TO REMEMBER

13 July 2020 – Abstract Due Date
Mid August 2020 – Abstract Authors Will Be Notified of Results
9 February 2020 – Final Presentations Due
8 - 11 March 2021 – Conference

TOPIC AREAS

TOPIC 1: THERMAL PROTECTION & MANAGEMENT SYSTEMS

This topic area includes all aspects of thermal protection systems (TPS) design to include active and passive approaches, analysis, and manufacturing that support ballistic, air-breathing, boost-glide, defense against hypersonics, high-energy kinetic projectiles, and re-entry systems for military applications. Program and system overviews with pertinent materials, issues, and updates related to current programs are also included. Focus areas include:

- Design and ground/flight testing of thermal protection systems concept or components;
- Thermal management of subsystems including active & passive technologies;
- Sensor and antenna window integration;
- Novel instrumentation or applications to support TPS development;
- Materials for TPS applications;
- Oxidation/ablation modeling and test;
- Erosion modeling and test, to include weather effects;
- Thermostructural modeling, material properties, and testing;
- Advanced structural concepts and TPS integration;
- Industrial base;
- Sustainability;
- Manufacturing methods of TPS elements; and
- Nosetips and leading edges.

TOPIC 2: PROPULSION

This topic area addresses propulsion concepts that support hypersonic flight for expendable and reusable systems. The main areas of interest include rocket and air-breathing propulsion, and responsive solutions for end game maneuverability. While concept development phase activities are of interest, consideration will be given to elevated Technology Readiness Levels (TRLs) and Manufacturing Readiness Levels (MRLs) where ground and flight test data from prototype propulsion components and systems are available.

Rocket Motor Areas of Interest Include:

- Booster motors/booster systems with multiple stages demonstrated via ground testing;
- Nozzle and thrust vectoring systems;
- Approaches to thrust modulation and termination;
- High performance propellants with low sensitivity;
- Launch and operating environments design consideration; and
- Divert and Attitude Control Systems (DACs).

Air-Breathing (Systems Level) Propulsion Areas of Interest Include:

- Scramjet system and engine development programs;
- System design solutions addressing boost, cruise, and terminal phase requirements;
- Ground test methodologies, facilities, and test diagnostics;
- Engine material technologies; and
- Modeling and Simulation (M&S) with validation.

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TOPIC AREAS

TOPIC 3: AERODYNAMICS & AEROTHERMODYNAMICS

Aerodynamics and aerothermodynamics play a significant role in the design of hypersonic systems, driving flight vehicle performance and robustness. These phenomena must be adequately characterized with uncertainties identified to develop guidance and control methodologies. Due to the unique challenges associated with hypersonic flight coupling of the aerodynamic and aerothermodynamic environments, advanced modeling and simulation approaches, validated by ground/flight test and evaluation are required. The HTSC Aerodynamics and Aerothermodynamics topic area addresses the challenges and on-going investments in hypersonic system technology maturation. Focus areas include:

- Uncertainty modeling and quantification methods;
- Hypersonic flow field modeling and validation;
- Relevant vehicle boundary layer transition modeling, phenomenology, and test;
- Effects of flow field chemistry on vehicle performance;
- Effects of shock-shock and shock/boundary-layer interaction;
- Ground test methodologies and approaches (wind tunnels, shock tunnels, ballistic ranges);
- Aerodynamics influence on control surface performance;
- Ablation/erosion influence on aerodynamics coefficients;
- Jet interaction modeling and validation;
- Wake flow field modeling;
- Base region flow field and aeroheating modeling; and
- Flight test validation of aerodynamic models and configurations.

TOPIC 4: NAVIGATION, GUIDANCE & CONTROL, AND ELECTRICAL SYSTEMS

Hypersonic systems offer enabling capability to counter adversarial threats and provide the U.S. with significant advantages to address both offensive and defensive requirements. However, deviations from historical aerodynamic configurations and re-entry environmental challenges require technology maturation in Navigation, Guidance & Control (NG&C) and electrical systems to support hypersonic flight systems. This topic is focused on addressing these requirements for current and future configurations of interest within the hypersonic community. Topics of interest include:

- Challenges associated with hypersonic flight systems related to NG&C and electrical systems;
- Hypersonic power system and energy storage technologies and methods (flight and ground systems);
- Auto-pilot design and implementation for hypersonic systems and platforms;
- Navigation and guidance in GPS-contested environments;
- Tactical/strategic navigation systems;
- M-Code and hypersonic-specific code and algorithm implementation;
- Unique control system technology development and maturation for moderate to high lift/drag ratio vehicles;
- Packaging of electrical systems in constrained hypersonic vehicle configurations;
- Uncertainty analysis and contributors for NG&C systems;
- Latency mitigation methods & technologies for hypersonic systems; and
- Integration between NG&C, aerodynamic, aerothermodynamic, and power system simulation methods and analyses.

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TOPIC 5: PROGRAMMATIC REVIEW

Hypersonic R&D and flight system programs are being conducted by each of the services and agencies such as the Office of the Secretary of Defense, Defense Advanced Research Projects Agency, and the Strategic Capabilities Office. Each organization working on hypersonics brings unique skills and capabilities. Ground, air, or sea launch are examples of system differences while areas such as shape, range, size, and other key areas are vehicle unique design challenges. The program review area will focus on discussions related to current status and path forward for specific service and agency hypersonics programs.

TOPIC 6: DEFENSE AGAINST HYPERSONIC SYSTEMS

Hypersonic threats present a unique challenge to U.S. defensive systems. They operate at high velocity, are capable of high acceleration maneuvers, operate across a large range of altitudes, and do not have a predictable trajectory. This topic area will examine the applicability of current and future defensive systems against the hypersonic threat. This topic area is devoted to generation of key knowledge points, including modeling and simulation, to mature defensive systems that may include:

- Architecture concepts studies;
- Sensor / shooter interactions;
- Battle management and CONOPS;
- Fire control and engagement management;
- Targets and threats;
- All aspects of the threat kill chain (detect, track, engage, assess);
- Survivability of the defensive system;
- Determination of lethality (hard or soft kills); and
- Technical challenges of the mission.

TOPIC 7: DETECTING & TRACKING HYPERSONIC OBJECTS

This topic area will examine technologies and capabilities for detecting, countering the operation, and counter detection of hypersonic objects. There is a need to develop the capabilities to detect and defeat the adversaries' hypersonic threats in different flight scenarios. This topic area is devoted to examining possible detection techniques associated with the hypersonic dynamics and flight environment effects, as well as the possible techniques to counter such detection. For example, analysis and characterization of target, as well as clutter produced due to the presence of different types of density irregularities inside the flow around a hypersonic vehicle could provide valuable insights for new efficient detection and countering capabilities. Combined with technologies and testing associated with achieving hypersonic velocities, areas of interest include:

- Modeling, experiments, and phenomenology;
- Efficient algorithms and fusion;
- Interaction and scattering of multispectral beams with wave turbulence;
- Detection of hypersonic objects using specific spatial waveforms;
- Impact on navigation and guidance;
- Other topics specific to detection and countermeasure;
- Target signature effects to include impact of ablation, heating, turbulence; and
- Sensor platform capability and experimental results.

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TOPIC 8: SENSING IN A HYPERSONIC ENVIRONMENT

Existing subsonic missiles have developed terminal sensors to increase accuracy and lethality for both stationary and moving targets. This topic seeks abstracts that investigate terminal, ISR, and homing sensors for offensive and defensive system. The high-speed environment adds additional difficulty due to compressed engagement timeline, high surface temperature on the sensor window, and limited aperture size. In addition, future capability requirements may drive the need for developing the ability to send and receive multiple signal types and thus require a variety of sensors and windows. Areas of interest include:

- Sensor trade studies for a hypersonic environment;
- High temperature antennae and window materials;
- Propagation of signals through high temperature materials and flow fields;
- Sensor designs for hypersonic vehicles;
- Ground test facilities for combined hypersonic environment testing related to sensing;
- Modeling and simulation of hypersonic engagements of a moving target; and
- Target discrimination in a time constrained environment.

TOPIC 9: GROUND TEST FACILITIES & INSTRUMENTATION

This topic area addresses ground test and evaluation of hypersonic weapon technologies, components, and systems to validate models and support flight system development. Abstracts are being sought from DoD, DOE, NASA, and private industry that are developing and utilizing government-owned or commercial ground test facilities to address and mature hypersonic technologies for weapon systems. Areas of interest include, but are not limited to:

- Methods of using ground testing to reduce flight test risk;
- Capabilities of existing ground test facilities;
- Ongoing and proposed facility upgrades;
- The technical challenges of future facility needs;
- Novel hypersonic instrumentation applicable to ground and flight test data acquisition; and
- Current ground test activities supporting hypersonic flight system development (characterization, as well as qualification testing).

TOPIC 10: SYSTEMS ENGINEERING, ARCHITECTURE, ANALYSIS & DESIGN

Systems Engineering, Architecture, Analysis & Design involves developing and executing multidisciplinary solutions to enable emerging hypersonic platform capabilities, as well as vehicle level integration of subsystems into hypersonic platforms across all mission phases and life cycle. This topic area will also cover multidisciplinary trade study methods to optimize system performance in a highly constrained environment. Specific focus will include, but is not limited to:

- Integration of systems components (flight electronics, ordnance, controls);
- Integration of sensors/windows into heatshields and outer mold lines (OMLs);
- Performance trades with competing weight, range, payload parameters;
- Launch system integration;
- System architectures to provide operational capabilities;
- Modeling, simulation, and analysis to provide insights into operational effectiveness;
- Booster-to-vehicle integration;
- Fluid thermal structural interaction;
- Model based system engineering;
- Affordability & producibility; and
- Reliability & maintainability.

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TOPIC 11: FLIGHT TESTING

Hypersonic flight tests have been conducted for several years, the results of which have brought a wealth of data about the characteristics of hypersonic flight. DARPA, DOE, NASA and the defense services have demonstrated various key technological areas using sled tests and wind tunnel tests and have conducted full system flight tests. This topic area is dedicated to plans, objectives, results, challenges and other items related to hypersonic flight testing. It explores new ways to do flight tests in a resource and schedule constrained environments. Topics such as accuracy, maneuvers, thermal protection capabilities, all weather operations, range infrastructure, post flight recovery, flight termination, diagnostics, measurements, communications, security and capabilities will also be addressed. The ultimate goal is to share knowledge and plans of hypersonic flight testing and determine where knowledge and efforts can be leveraged.

TOPIC 12: KILL CHAIN, MISSION PLANNING & C4ISR

The ability to employ hypersonic systems (offense and defensive) in compressed timelines is of extreme importance to the DoD. This session will examine various capabilities and the technologies related to: resource management, ISR, targeting, command and control, C2BMC, communication and decision making as it applies to employing hypersonic capabilities. Areas of interest include:

- Compressing the kill chain to reduce our adversaries' decision time;
- Energy management and trajectory optimization with vehicle constraints;
- ISR, target and identification and cueing/custody;
- Application of artificial intelligence capabilities;
- Mission and flight planning;
- Decision making;
- Target assignment;
- Development of weapons quality data; and
- Defensive and survivability constraints.

TOPIC 13: WEAPONS EFFECTS & LETHALITY

This environment presents unique challenges in weapon effects and system lethality assessments. This topic is seeking abstracts on weapon effects and lethality related to hypersonic offensive and defensive systems. Areas of interest include:

- Modeling and simulation of weapon effects;
- Modeling and simulation of lethality;
- Lethality data integration into weaponeering tools;
- Minimizing collateral damage;
- Kill assessment methodologies;
- Ground and flight testing;
- Campaign employment and target-weapon pairing;
- Advanced technologies in hard-kill and soft-kill;
- Fuzing, energetic materials, lethality enhancements;
- Post-intercept debris and damage state characterization;
- Implications on shot doctrine; and
- Communication between platforms to optimize lethality.

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ABSTRACT SUBMISSION

We look forward to receiving your abstract(s) for the 2021 Hypersonic Technology & Systems Conference. This event is restricted and conducted at the SECRET//NOFORN level. Attendance is limited to U.S. citizens with a final SECRET clearance. Final presentations should not be more restrictive than Distribution C.

ABSTRACT & SUBMISSION REQUIREMENTS

- **Abstracts must be unclassified.**
- Abstracts should carry a distribution level of A or C. If your presentation material is not derived from work done under DoD funding or oversight, please use your organization's equivalent to the distribution levels below.
 - A = Approved for public release, distribution unlimited
 - C = U.S. Government Agencies and their contractors only
- Abstract submissions more restrictive than Distribution A should be password protected with passwords being sent to Sherry Johnson at sjohnson@blue52productions.com. More detailed instructions for password protecting and submitting your abstracts can be found on the submission page on-line.
- Because of the high interest in this event, we are expecting a very large number of submissions for the 2021 HTSC. Presentations that have content beyond the unclassified level, are clearly associated with the proposed topic area(s) and are technically focused (versus company sales pitches) will have the highest probability of selection. Please remember that HTSC has a greater emphasis on platform and applied technology versus purely basic or foundational research which is covered at other conferences.
- Abstracts should be relevant to one or more of the topics described on the previous pages.
- Abstracts should be no more than 400 words long.
- Abstracts must contain an unclassified outline containing the key points of your presentation (this does not count against the 400 word count).
- Abstracts should include the title of your abstract in the body of the submission (this does not count against the 400 word count).
- Abstracts should clearly express: 1) objective, 2) relevance to the proposed topic area(s), 3) scope, and 4) conclusions of your presentation.
- If appropriate, be sure to have your derivative classifier do a sanity check on your unclassified abstract prior to submitting it.
- If you find it impossible to submit a worthwhile abstract at the unclassified level, please call Michelle Williams at 937-554-4632 for potential alternative options.
- **IMPORTANT:** Speed up your organizational release process of your abstract by letting your approvers know that abstracts will not be published on the web or in proceedings, nor will they be distributed beyond the technical selection committee.

NOTIFICATION & PRESENTATION INFORMATION

In August 2020 you will be contacted regarding the status of your acceptance. Final presentations will be due 9 February 2021. Please note that selection and presentation of an abstract, whether oral or poster, does not waive any applicable registration fees.

TO SUBMIT YOUR ABSTRACT, VISIT

<https://www.usasymposium.com/Hypersonics/cfa.php>