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HTSC

HYPERSONIC TECHNOLOGY &
SYSTEMS CONFERENCE

16 - 19 October 2023, North Logan, UT



CALL FOR ABSTRACTS

Abstract Due Date: 3 May 2023

We invite you to participate in the fifth annual Hypersonic Technology & Systems Conference (HTSC) which will take place in North Logan, Utah, 16 - 19 Oct 2023.

PLEASE JOIN US!

Sustained hypersonic flight within 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 these systems is also of increased interest. The technologies required to enable the reliable use of hypersonic vehicles are multi-disciplinary. Some of the technologies that HTSC focuses on include:

- Programmatic Review
- Aerodynamics & Aerothermodynamics
- Defense Against Hypersonic Systems
- Detecting & Tracking Hypersonic Objects
- Flight Experimentation & Testing
- Ground Test Campaigns & Facilities
- Kill Chain, Mission Planning & C4ISR
- Modeling & Simulation, Analysis, and Design
- Navigation, Guidance & Control, and Electrical Systems
- Propulsion
- Sensing in a Hypersonic Environment
- Systems Engineering
- Thermal Protection & Management Systems
- Weapon Effects & Lethality

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
Amentum
Army Combat Capability Development Command Aviation & Missile Center
Army Engineer Research & Development Center
Arnold Engineering Development Complex
The Boeing Company
Defense Advanced Research Projects Agency
Georgia Tech Research Institute
The Johns Hopkins University Applied Physics Laboratory
Leidos
Lockheed Martin Corporation
Missile Defense Agency
MIT Lincoln Laboratory
NASA Langley Research Center
National Geospatial-Intelligence Agency
Naval Surface Warfare Center
Navy Conventional Prompt Strike
Northrop Grumman Corporation
Office of Naval Research
Office of the Under Secretary for Defense Research & Engineering
Parallax Advanced Research
PeopleTec, Inc.
Raytheon Missiles & Defense
ReLogic Research, Inc.
RTCS, LLC

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

KEY DATES TO REMEMBER

3 May 2023 – Abstract Due Date
June 2023 – Abstract Authors Will Be Notified of Results
20 September 2023 – Final Presentations Due
16 - 19 October 2023 – Conference

TOPIC AREAS

TOPIC 1: THERMAL PROTECTION & MANAGEMENT SYSTEMS

The thermal protection and management systems topic includes all aspects of materials, manufacturing, and design that support ballistic, air-breathing, boost-glide, defense against hypersonics, high-energy kinetic projectiles, and re-entry systems for military applications. In this topic, TPS is a general term for all external structures to include but not limited to aeroshells, windows, apertures, radomes, control surfaces, nosetips, and leading edges. Program and system overviews with pertinent materials, issues, and updates related to current programs are encouraged. Focus areas include:

- Design and ground/flight testing of thermal protection systems concept or components;
- Thermal management of subsystems including active & passive technologies;
- Novel instrumentation or applications to support TPS development;
- Oxidation/ablation modeling and test;
- Erosion modeling and test, to include all environmental effects;
- Thermostructural modeling, material properties, and testing;
- Advanced structural concepts and TPS integration;
- Manufacturing methods and the industrial base; and
- Sustainability.

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:

- Air-breathing systems (to include scramjet, ramjet, rotating detonation engine, and turbine based) 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 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 & 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 and signature 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;
- Electrical failure analysis and unique electrical phenomena related to hypersonic 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 AREAS

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, capabilities, and lessons learned. 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 and 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. Important to success in this area are development of methodologies and systems that employ an all domain approach, network-centric operation, and distributed decision making. Combined with technologies and testing associated with achieving hypersonic velocities, areas of interest include:

- Modeling, experiments, and phenomenology;
- Efficient algorithms and fusion;
- Machine learning and autonomy;
- 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;
- Vehicle signature effects to include impact of ablation, heating, turbulence; and
- Sensor platform capability and experimental results.

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TOPIC AREAS

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 systems. 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;
- In flight non-contact methods of diagnostics of hypersonic environment;
- High temperature antennae and window materials;
- Wave propagation using space domain and time FDTD simulations in hypersonic environment;
- Propagation of signals through high temperature materials and flow fields;
- Signal processing;
- 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 CAMPAIGNS & FACILITIES

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;
- Ground test results and analysis;
- Hardware in the loop;
- 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).

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For more information, contact Kelli Jameson, kjameson@blue52productions.com or visit
<https://www.usasymposium.com/Hypersonics/sponsorship.php>.

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TOPIC 10: SYSTEMS ENGINEERING

Systems Engineering 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 design methods to optimize system performance in a highly constrained environment. Specific focus will include, but is not limited to:

- Integration of subsystems (flight electronics, ordnance, controls, etc.);
- Performance trades with competing weight, range, payload parameters;
- Integration, test, and assembly, as well as launch system integration;
- System architectures and design to provide operational capabilities;
- Booster-to-vehicle integration;
- Model based system engineering;
- Affordability & producibility;
- Reliability & maintainability;
- Mission, campaign, and wargaming simulations;
- Digital engineering applicable to hypersonic systems; and
- Applicable systems engineering lessons learned.

TOPIC 11: FLIGHT EXPERIMENTATION & TESTING

Hypersonic flight experiments and 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 conduct flight tests in a resource and schedule constrained environment. 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 experimentation and testing and determine where knowledge and efforts can be leveraged.

TOPIC 12: KILL CHAIN, MISSION PLANNING & C4ISR

The ability to employ hypersonic systems (offensive 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 (offensive and defensive) and flight planning;
- Decision making;
- Target assignment;
- Development of weapons quality data; and
- Defensive and survivability constraints.

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TOPIC AREAS

TOPIC 13: WEAPONS EFFECTS & LETHALITY

This environment presents unique challenges in weapon effects and system lethality assessments against various target types - including structural, and air land and sea vehicles. 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.

TOPIC 14: MODELING & SIMULATION, ANALYSIS, AND DESIGN

The Modeling and Simulation, Analysis, and Design topic includes all aspects of the design and sustainment life cycle for air-vehicles, weapon systems, and warhead solutions engaging in hypersonic flight and deployment. Being able to accurately capture the complex physical interactions in a dynamic environment associated with this flight regime is critical to ensuring both strategic and operational advantage in today's fast-paced S&T arena. In addition, advancing multidisciplinary trade study methods to optimize system performance in a highly constrained environment is also of critical importance. Specific focus areas for this topic will include, but are not limited to:

- Existing high-fidelity and weaponeering modeling and simulation solutions;
- Technologies for analyzing/visualizing large data sets;
- Minimizing program costs and schedule utilizing modeling and simulation;
- MS&A to provide insights into operational effectiveness;
- Design optimization trade studies;
- Toolset advancements to account for extreme environments;
- Non-deterministic MS&A approaches;
- Uncertainty quantification techniques;
- MS&A validation against ground and/or flight test data;
- Efficient computer processing architectures (HPC, clusters) and unique verification and validation challenges; and
- Implementation and execution within a digital engineering ecosystem/environment.

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ABSTRACT SUBMISSION

TO SUBMIT YOUR ABSTRACT, VISIT

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

We look forward to receiving your abstract(s) for the 2023 HTSC. This event is restricted to 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
- Abstracts that contain CUI data, must have a CUI control block and be marked CUI at the top and bottom.
- 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. Presentations that contain classified information, 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 the title of your abstract in the body of the submission and an unclassified outline containing the key points of your presentation (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 or need Distro F approval, please contact Michelle Williams at mkw@blue52productions.com.
- **IMPORTANT:** Speed up your organizational release process of your abstract by letting your approvers know that abstracts will not be published on the web, nor will they be distributed beyond the technical selection committee.

NOTIFICATION & PRESENTATION INFORMATION

In June 2023, you will be contacted regarding the status of your acceptance. Final presentations will be due 20 September 2023. Please note that selection and presentation of an abstract, whether oral or poster, does not waive registration fees. All speakers and posters will need to register and pay the applicable fees.

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