JANNAF
INTERAGENCY PROPULSION COMMITTEE

72nd JPM | PIB Meeting | 53rd CS | 41st APS
41st EPSS | 35th ESHS | 19th MSS
Joint Subcommittee Meeting

Call for Papers

9 - 13 June 2025 | Spokane, WA

Abstract Deadline:
31 January 2025

Image Credit: Lockheed Martin

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What? June 2025 JANNAF Interagency Propulsion Committee meeting

When? Monday through Friday, 9-13 June 2025

Where? Spokane, Washington

Unclassified: Spokane Convention Center

Classified: Fairchild Air Force Base

Meeting Chair:
Dr. Robert A. Baurle, Air Force Research Laboratory, Wright-Patterson AFB, Ohio

The following subcommittees will meet:

JANNAF Propulsion Meeting (JPM)
Programmatic and Industrial Base (PIB)
Combustion (CS)
Airbreathing Propulsion (APS)
Exhaust Plume and Signatures (EPSS)
Energetic Systems Hazards (ESHS)
Modeling and Simulation (MSS)

For additional information, visit the June meeting page.

WHY SHOULD YOU ATTEND A JANNAF MEETING?

[According to previous JANNAF Meeting attendees]

ATTENDANCE REQUIREMENTS

The overall security level of the meeting is **Secret**. Unclassified sessions will be held at the Spokane Convention Center; classified sessions will be held at Fairchild Air Force Base, approximately a minute drive from the hotel. Attendance is restricted to U.S. citizens employed by a DoD, DoE, or NASA facility, or with a DoD, DoE, or NASA contractor facility eligible for receipt of militarily-critical technical data. No foreign nationals are permitted to attend.

To attend the classified sessions, attendees must also possess a personal security clearance of at least Secret with a need-to-know in the areas of rocket, missile, space, aircraft, or gun propulsion.

All attendees will need to have an active JANNAF account. Instructions can be found here.

Non-government attendees (including contractors, consultants, and universities) will need the following:

1. Current government contract or certification from a Sponsoring Government Official
2. Employer's DD 2345 certification number for receipt of militarily-critical technical data

DD 2345: For additional information, contact the Joint Certification Program Office (JCP) at 1-800-352-3572 or visit their web site at https://www.dla.mil/HQ/LogisticsOperations/Services/JCP/.

Questions concerning attendance eligibility and JANNAF account access should be directed to Mionna Sharp (msharp@erg.jhu.edu) or by calling (410) 992-7300 ext. 224.

REGISTRATION

Preliminary registration information is provided on the June meeting website with full details available when registration opens in late March. All attendees, including presenters, must register and pay the registration fee.

PURPOSE

The JANNAF Interagency Propulsion Committee focuses on the technology, development, and production capabilities for all types of propulsion systems and energetics for tactical, strategic and missile defense rockets and missiles, for space boost and orbit transfer, for in-space propulsion, and for gun systems. JANNAF provides a forum for discussion of propulsion issues, challenges, and opportunities across the Military Departments, Defense Agencies and NASA. JANNAF subcommittees focus their resources on technical issues of interest to the JANNAF agencies. JANNAF accepts papers that are unclassified/unlimited and unclassified/limited for all meetings; and up to classified Secret as announced in the specific meeting's announcement and call for papers.

ABSTRACT SUBMITTAL GUIDANCE

- The technical areas to be addressed are defined in this announcement. Individuals who wish to submit an abstract should carefully review the topic areas listed on pages 8 - 28.
- **The deadline date for submission of the online Abstract Form is 31 January 2025**. If you need to submit an abstract after this date, please contact ERG (meetings@erg.jhu.edu).
- **Your organization may require abstracts to be processed through an approval system prior to submission. This process takes additional time, so authors should plan accordingly to meet the abstract deadline date.**
- Submitting an abstract represents an agreement to **submit a final paper for publication by 9 May 2025**, attend the meeting, and deliver a 25-minute presentation or a poster. The JANNAF Policy of "No Paper, No Podium" will be in effect for this meeting, with the exception of posters.
- **All abstracts are to be submitted via the JANNAF Abstract Submittal Site**. A JANNAF account is NOT required to submit an abstract.
- Submit only unclassified abstracts with content that is distribution statement A (approved for public release) or C (distribution authorized to U.S. Government and its contractors). **Abstracts will NOT be published** and will only be used by the program committee members for selection and scheduling purposes.
- You will be asked to indicate your presentation's anticipated Distribution Statement when completing required fields on the Abstract Submittal Site.
  - » Dissemination of information from JANNAF presentations is primarily relegated to either Statement A (approved for public release) or Statement C (Distribution authorized to U.S. Government and their contractors).
  - » To properly secure them, presentations marked with Statement B (U.S. Government agencies only), Statement D (U.S. Department of Defense and U.S. DoD Contractors only), or Statement E (U.S. Department of Defense components only), must be placed at the beginning of session agendas.
  - » Papers may have different Distribution Statements than their corresponding presentations.
- The Title field on the Abstract Submittal Site is limited to 150 characters including spaces.
- Only a primary author should be listed when submitting your abstract, unless the presenting author is someone other than the primary author. If accepted, you may list as many authors when submitting your final paper and all names will be included in the author list when the paper is published in JDOC.
- Abstract length is limited to 300 words, and may not include tables or figures. State the objective of the work. Describe the scope, method of approach, and any new advances in the state of the art. Highlight important conclusions, and include a brief summary of the data used to substantiate them.
- Indicate confirmation of required resources when completing the required fields on the Abstract Submittal Site to ensure availability of time, funding, and support for your participation in the meeting. This is NOT related to security review/approval to submit the abstract or submit/present the paper. A "no" response to this question will place your abstract in placeholder status.
- If the abstract deadline is approaching and you have not received approval to release your abstract, please contact the ERG meetings team (meetings@erg.jhu.edu) for guidance on submitting a placeholder.
- When filling in the form in the Abstract Submittal Site, if there is required information that you do not have, you have the ability to save your form and return once you have obtained the missing information to complete and submit the form.

ABSTRACT SUBMITTAL INSTRUCTIONS

JHU WSE ERG accepts only **electronic submission** of abstracts, presentations, and papers. **Abstracts must be submitted only via the Abstract Submittal Site:**

1. To access the Abstract Submittal Site, go to: https://jannaf.org/abstractstart. You may submit an abstract ***with or without*** an active JANNAF Secure Portal Account. Contact meetings@erg.jhu.edu if you require assistance.
   - » If you are submitting an abstract without an active JANNAF Account, and have not received a validation code (from info@erg.jhu.edu) within 30 minutes after you have submitted a request, after confirming that the message is not in your junk/spam folder, email meetings@erg.jhu.edu.
   - » If you are submitting an abstract without an active JANNAF Account, you may use your validation code to submit more than one abstract.
2. After reaching the Abstract Landing Page, select the June 2025 meeting, and then click the dark blue "Create new abstract" button to create a new abstract or edit/submit a draft abstract.
   - » Once you have reached the Submission Details tab, you will have the option to save the form as a draft and return to complete it at a later time.
3. When all required fields have been completed accurately, submit your abstract. You will have the opportunity to review your responses before you submit.

AUTHOR TIMELINE

Dates below are subject to change.

Date	Weeks to Meeting	Action
31 Jan 2025	18	Deadline for receipt of abstracts via Abstract Submittal Site.
10 Mar 2025	13	Approximate date for committee decision emails sent to authors.
14 Mar 2025	12	Deadline for changes to Meeting Invitation and Preliminary Program.
31 Mar 2025	10	Approximate date for Meeting Invitation, Preliminary Program, and registration materials forwarded to propulsion community.
4 Apr 2025	9	Deadline for award nominations and submittal of Student papers for Best Student Paper award consideration
25 Apr 2025	6	Deadline for submission of changes to the Final Program
9 May 2025	4	Last day for discounted Early registration fee.
9 May 2025	4	Deadline for receipt of papers and publication clearance forms. Papers not received by this date may be removed from the program.
19 May 2025	2	Deadline for reservations at Doubletree by Hilton Spokane City Center.
23 May 2025	2	Last day to pre-register online (registration form submission and registration fee payment). Late registration required thereafter.
23 May 2025	2	Deadline for receipt of presentations
9 June 2025	0	Start date for JPM/PIB/CS/APS/EPSS/ESHS/MSS Joint Subcommittee Meeting

MEETING SUBCOMMITTEES & MISSION AREAS

Click on the Mission Area of interest in the chart below to jump to that section in this Call for Papers.

Mission Area	JPM	CS	APS	EPSS	ESHS	MSS
I	Tactical Propulsion	Ignition and Combustion of Gun Propellants	Turbopropulsion	Plume / Wake / Hypersonic Flowfield Analysis	Thermal Decomposition and Cookoff	Model-Based Engineering
II	Missile Defense / Strategic Propulsion	Solid Propellants and Combustion	Ramjet Propulsion	Plume / Wake / Hypersonic Radiation and Signatures	Shock / Impact-Induced Reactions	Integrated Health Management
III	Propulsion Systems for Space Access	Explosive Performance / Enhanced Blast	Scramjet Propulsion	Plume / Wake / Hypersonic Effects	Insensitive Munitions Technology	Simulation Credibility: Verification, Validation, and Risk
IV	Gun and Gun-Launched Propulsion	Airbreathing Combustion	Combined / Advanced Cycle Propulsion	Additional Plume / Wake / Hypersonic Topics	Combustion Vulnerability of Stowed Energetics	Model Based Test and Evaluation (MBTE)
V	Propulsion and Energetics Test Facilities	Combustion Diagnostics	Integrated Vehicle Design and Analysis	Composite Scene Signatures of Plume / Wake / Hypersonic Flowfield and Hardbody Configurations	Safety and Hazard Classification of Solid and Liquid Energetics	
VI	Sensors for Propulsion Measurement Applications	Liquid, Hybrid and Novel Propellants Combustion	High-Speed Aerodynamics		Energetic Defect Characterization	

JANNAF PROPULSION MEETING

JHU WSE ERG Technical Representative
Mr. Michael "Miki" Fedun / JHU WSE ERG / Columbia, MD
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The JANNAF Propulsion Meeting (JPM) encompasses research and applications at the systems level. The JPM is held each year in conjunction with standing JANNAF subcommittee meetings on a rotating basis. The scope of the 72nd JPM in 2025 spans six mission areas (MA): Tactical Propulsion; Missile Defense/Strategic Propulsion; Propulsion Systems for Space Access; Gun and Gun-Launched Propulsion; Propulsion and Energetics Test Facilities; and Sensors for Propulsion Measurement Applications.

The 72nd JANNAF Propulsion Meeting sessions will cover systems development within the six mission areas described below. Questions concerning these areas or the topics being solicited should be directed to the JHU WSE ERG Technical Representative for JPM.

Mission Area I:
Tactical Propulsion

This area encompasses all tactical propulsion systems including those applicable to air-to-air; air-to-surface, surface launched and underwater missions. Typical systems include tactical missile boosters or sustainers, kinetic energy missiles, free-flight rockets, anti-radiation, anti-ship, anti-armor, anti-personnel/materiel missiles, ramjets, scramjets, and combined cycle propulsion. System studies that evaluate advanced propulsion concepts and demonstrations that incorporate one or more component technologies applicable to tactical propulsion are of interest. Examples of component technologies include propellants and fuels, fuel management systems, cases and combustors, inlets, nozzles, thrust vector control systems, thrust management systems, and advanced materials applications. Life cycle cost and demilitarization are also topics of interest.

Manufacturing technologies and fabrication techniques: Papers are requested that emphasize manufacturing technologies and fabrication techniques. Papers need not be associated with a particular system but should be applicable to materials associated with such vehicles and their corresponding flight environment. Abstracts are especially sought on the following topics:

- Airbreathing propulsion systems
- Hybrid propulsion systems
- Solid propellant rocket propulsion systems
- Demilitarization
- Hypersonic propulsion systems
- Improved missile kinematics
- Insensitive munitions (from a systems perspective)
- Propulsion system product improvement
- Manufacturing technologies and fabrication techniques

Airframe Structures and Materials: Materials development and characterization, and structural concepts, design, test, and validation for Airframe applications and components exposed to extreme environments as found in atmospheric high speed or reentry conditions. Topics of interest include: TPS and hot structures, materials, structures and related technology for leading edges, exterior acreage surfaces, control surfaces, hot structures, and seals (penetrations). Further topics include hot and integrated structures; acreage thermal protection systems, including ceramic matrix composites, tiles, blankets, ablators, and metallics; fuel tanks, including cryogenic and hydrocarbon, composite and metallic; leading edges, including active, passive, and heat-pipe-cooled; design and analysis methods; and seals. System-level design and analysis methods for power and thermal

balancing the various heat loads with available heat sinks, especially time-unsteady are of interest. Papers on structures and materials that have recently flown, or are planned for flight, on flight vehicles are encouraged.

Mission Area II:
Missile Defense / Strategic Propulsion

This area includes technology applicable to ballistic missiles, trans-atmospheric vehicles, and missile defense. Emphasis should be on system-level papers discussing propulsion technology for new vehicle systems, upgrades, modernization and sustainment; failure investigations; and economic considerations that include evolving business practices, life cycle cost estimation, and approaches that reduce development and operations costs and schedules. Papers are requested that emphasize sustainable manufacturing technologies and fabrication techniques. Papers need not be associated with a particular system but should be applicable to materials associated with such vehicles and their corresponding flight environment. Abstracts are especially sought in the areas of:

- Ground-based and sea-based strategic systems
- Ground-based, aircraft-based and sea-based missile defense
- Anti-satellite systems
- Advanced (including low or non-toxic) propellants
- Advanced (including light weight and/or high temperature) materials
- Insensitive munitions technologies
- Energy management approaches
- Dual mode systems (airbreathing/rocket)
- Unconventional propulsion
- Divert propulsion/attitude control propulsion
- Post boost control system propulsion
- Innovative propellant tank and valve technologies (including hot gas valves/pintles)
- Aging and Surveillance of propulsion systems
- Methodologies for determining space propulsion system useful life from design analysis and ground-based testing
- Manufacturing technologies and fabrication techniques including the use of 3D printing for strategic and missile defense propulsion system components
- US-sourced sustainable materials
- Demilitarization or alternative applications of heritage propulsion system

Mission Area III:
Propulsion Systems for Space Access

This area focuses on existing or potential primary and auxiliary government, commercial or foreign propulsion systems for earth-to-orbit vehicles or in-space propulsion systems. Emphasis should be on system-level papers discussing propulsion technologies for new vehicle systems, upgrades and modernization, failure investigations, and evolving business practices that reduce development and operations costs while increasing mission reliability. Papers should address future access to space missions, future exploration missions and needs, vehicle system architectures, and the identification of critical propulsion requirements technologies that must be enabled to support these new system requirements.

Manufacturing technologies and fabrication techniques: Papers are requested that emphasize manufacturing technologies and fabrication techniques. Papers need not be associated with a particular system but should be applicable to materials associated with such vehicles and their corresponding flight environment. Abstracts are especially sought in the following areas:

- Methods for development of design reference missions and vehicle systems architecture
- Future or current Vehicle systems that use either solid or liquid propulsion
- Description of vehicle systems analysis models and assumptions including risk
- Description of vehicle system full scale testing versus model analysis and assumptions including risk
- Details of architecture studies and descriptions of promising vehicle architectures
- Uncertainty evaluation of vehicle systems analysis
- Cybersecurity and its relationship to operation and protection or risk of vehicle or propulsion systems
- Results of sensitivity analysis of key parameters on vehicle dry mass fraction margin, gross take-off weight, cost, reliability, and safety, with emphasis on propulsion
- Methods for identification and prioritization of critical enabling propulsion technologies
- Approaches for utilizing higher fidelity propulsion analyses in the overall systems architecture model(s)
- Methods to standardize model assumptions and fidelity in order to make relevant comparisons between vehicle architectures and various propulsion system options
- Description of promising new propulsion systems including risk assumptions
- Description and status of the access to space propulsion system technology or development activities
- Small launch vehicle mission analysis
- System analysis for responsive space access
- Manufacturing technologies and fabrication techniques
- Manufacturing use of 3D printing for propulsion hardware
- Testing use of 3D printing for propulsion hardware

Mission Area IV:
Gun and Gun-Launched Propulsion

This area embraces technologies applicable to small-, intermediate-, or large-caliber guns, as well as gun-launched rocket propulsion, for air, sea, or ground/mobile weapons systems. Typical rocket assisted systems include kinetic energy missiles and extended range projectiles, both guided and unguided. Abstracts are especially sought in the following areas:

- Conventional Gun Propulsion Concepts to Include Solid and Liquid Propellants
- Unconventional Gun Propulsion Concepts
- System-level Gun Propulsion Studies (gun tube wear and erosion, blast/flash mitigation, improved system survivability)
- Concepts to Enable Propulsion Systems (i.e. gun barrel and/or rocket motor case) to Achieve Higher Operating Pressures
- Assisted Projectiles
- Assisted Guided Munitions
- Propulsion Design and Accommodation for Novel Launch Packages to Include UXV
- Insensitive Munitions
- Gun Propulsion Concepts using Additive/Advanced Manufacturing Methods

- Gun Propulsion Concepts to Increase Loading Density and/or Deliver Highly Optimized Gas Generation Rates (GGR)
- Novel Ignition System and Propelling Charge Architectures

Mission Area V:
Propulsion and Energetics Test Facilities

This area targets issues, technologies and achievements relevant to the operation and use of rocket propulsion test facilities for demonstration, development, characterization, and qualification of rocket, spacecraft, and gun propulsion systems, energetics, and materials for propulsion applications. Eligible test facilities include static test facilities for liquid rocket engines, solid rocket motors, electric and in-space propulsion systems, hypersonic test facilities, gel motors, hybrid propulsion systems, explosives, insensitive munitions, wind tunnels, altitude/vacuum chambers, and other rocket propulsion technologies; laboratory test facilities for energetics and materials science characterization; and test ranges for missiles, guns and rocket sleds. Abstracts are specifically solicited on the following topics:

- Best practices and testing standards
- Integrating instrumentation, controls and data acquisition systems
- Static thrust measurement systems
- Propellant and materials handling and safety
- Accident and incident lessons learned
- Test facility modeling

Abstracts on improvements in base infrastructure, updates and upgrades of test stand capabilities, new propellant inventories, or other general advertisements of capabilities or assets will not be considered for this area

Mission Area VI:
Sensors for Propulsion Measurement Applications

This area captures technologies and advancements in sensors and measurement devices for rocket and gun propulsion applications. Emphasis should be on development, application, modeling and integration of sensors for use in various propulsion applications. Abstracts are specifically sought on systems and sensors for:

- Storage, tanking and cryogenic systems, including true cryogenic mass flow, cryogenic temperature measurement, mass and level measurement in micro and zero gravity, pump and turbomachinery induced pressure fluctuations, leak and tank integrity monitoring, and other propellant feed and storage measurements
- High-temperature systems and hostile environments, including: extreme high-temperature measurements, real-time nozzle erosions and fuel regression, material ablation, flame propagation, high temperature electronics, packaging, and communications, and measurement and analysis of thermal effects on pressure transducers
- In-chamber diagnostics, including development of methods to make measurements of velocity, temperature, pressure, and/or other flow quantities inside of firing combustion chambers
- Plume measurement technology, including methods to utilize plume measurements to understand chamber operating conditions and spacecraft contamination issues
- Systems health monitoring and non-destructive evaluation (NDE) and repair, including: test stand characterization and control, structure and sense line frequency characterization, micro and nanotechnologies, systems for conversion of sensor data into actionable knowledge, technologies for intelligent health management systems, integrated fiber optics, electromagnetic NDE technologies, NDE data processing and analysis, life cycle monitoring of solid rocket motors, and monitoring of aeroshells and ballutes during reentry

- Smart sensing technology, including the development of sensors capable of automatic calibration and fault detection; intelligent sensors that are calibrated in situ and provide dynamic compensation for environmental changes (temperature, humidity, etc.); fault detection also including any fault that would cause a sensor to provide inaccurate information such as sensor damage, lead wire damage or disconnection, and the disbonding or detorquing of the sensor; smart and distributed sensor system approaches, systems architectures, and applications
- Chemical sensors suitable for solid rocket motor environments and applications (sensors of interest include those for measuring the chemical state or composition of a solid, including gaseous diffusion, liquid diffusion, changes in free volume, direct measurement of changes in molecular weight or molecular weight per crosslink due to chain scission or the reaction products which result from chain scission); and development and applications of sensors that do not alter the chemical equilibrium of the solid solution are of particular interest
- Sensor modeling and simulation including modeling and simulation methods for sensor selection and data validation approaches; and recent advances in micro/nano technology, embedded sensor systems, optical diagnostics, and multiparameter measurement technologies
- Sensor systems or approaches including embedded sensor systems enabled by advances in additive manufacturing
- Sensor systems associated with hybrid electric or all electric vehicle propulsion and vehicle systems.
- Methods for automating one or more manufacturing steps to improve speed, repeatability, safety, or other characteristics
- Non-destructive evaluation techniques, particularly in-situ or non-disruptive evaluation techniques that complement advanced manufacturing methods
- Design and analysis methods, techniques, and tools to assess materials and systems produced using manufacturing methods described in this mission area, to include those that address service life, reliability and critical defects assessments
- Studies that assess the merit of applying manufacturing methods described in this mission area to particular systems or classes of systems
- Development of Lot Acceptance Test (LAT) methods to measure the burn rate and mechanical properties that are efficient and effective for materials produced by additive manufacturing, to include alternatives to casting or extruding blocks of propellant to make burn rate strands and/or JANNAF dog-bones

PROGRAMMATIC AND INDUSTRIAL BASE

The JANNAF Programmatic and Industrial Base (PIB) Committee was chartered by the Department of Defense and the National Aeronautics and Space Administration in 2014 as a part of JANNAF. Its focus is on providing a mechanism for DoD and NASA Programs to collaboratively identify and manage risks and issues within the propulsion industrial base, and to work together to solve them. This requires an integrated understanding of each program's plans and key decision points, and how those decisions may impact the propulsion industrial base. PIB areas of interest include integrated program plans and key decision points; industrial base assessments; risks and opportunities with respect to skills, knowledge, and experience; identification of commonality, innovative acquisition, and partnership opportunities; integrated assessments to identify rocket propulsion industrial base (RPIB) rationalization opportunities; special actions from senior agency, department, or Executive Office of the President (EOP) leadership; and information provided to decision makers for either situational awareness or policy decisions.

COMBUSTION SUBCOMMITTEE

JHU WSE ERG Technical Representative
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The JANNAF 53rd Combustion Subcommittee meeting will include sessions on chemical combustion phenomena occurring within the interior of guns and combustors of solid, liquid, and airbreathing (including small or expendable turbojets) missile and space propulsion systems. Papers are also invited that will aid in synthesizing, interpreting, and validating current knowledge to make research and development results more useful to design engineers. **Specific areas of interest are listed below:**

Mission Area I:
Ignition and Combustion of Gun Propellants

Experimental and modeling studies of ignition, flame spreading, and combustion of solid propellants in guns, mortars and novel gas generators are considered. These studies include the investigation of ignition and ignitability, flame spreading, high-loading density charges, combustion temperature sensitivity, transient combustion (axial and radial pressure waves), and gun barrel erosion under high-pressure gun chamber conditions. Burn rate measurements and techniques, novel gun propelling charge concepts, interior ballistics of grain/stick/disk/consolidated and traveling charges are also considered. Innovative ignition systems and materials, novel chemical igniters and propellant formulations, experimental and analytical techniques to support the production of gun propellants and igniter materials, muzzle flash and blast, mechanical behavior and integrity of propellants in dynamic pressure wave environments, combustion behavior of thermally and mechanically damaged propellant, modeling and studies of surface-coated and deterred propellants, improved gun erosion and ballistic efficiencies through propellant chemical formulations and additive manufacturing are among the many topics included in this mission area. Papers on gun propellant ignition and combustion and propellant vulnerability will be considered for joint CS/PSHS sessions. Technical sessions will be organized as will specialist session that are aimed at discussing new and urgent topics (see below for a list of current topics).

Specialist Sessions

CHEETAH Users Group: As a follow-up to the CHEETAH workshop held at the 48th JANNAF CS Meeting in December 2017, the mission area chairs are soliciting technical presentations (presentation required but paper optional) that highlight applications of the CHEETAH model, observations and/or shortcomings of the model as documented by researchers, and extensions made or suggested to be made to the model for particular applications as performed by individual researchers. The organization of a CHEETAH specialist session will be based on the number of presentations received.

Advances in Gun Tube Erosion Analysis and Testing: A majority of the armed services are proposing extended range munitions that can provide battlefield overreach for lethality (range) and terminal effects (velocity). One of the pivotal issues in weapons systems development and maintenance is the material erosion of the gun tube after repeated use – this erosion is caused by both mechanical and chemical processes and is highly dependent on propellant thermo-chemistry. M&S as well as laboratory-scale testing is often used to investigate erosion, but the problem is very complex. We are soliciting technical presentations (presentation required but paper submission is optional) that highlight R&D in gun tube erosion, modeling and simulation as well as lab-scale and simulator testing and propellant characterization. Presentations that address the problem in broad terms as well as those that investigate root causes are equally encouraged. It is planned to solicit the participation of subject matter experts (SMEs) in gun tube erosion from all of the services. The organization of a Gun Tube Erosion Analysis and Testing specialist session will be based on the availability of the SME's and the number of presentations received.

Gun Propellant Burnrate Determination: As a follow-up to the JANNAF Closed Bomb Round Robin (1982) and subsequent JANNAF Closed Bomb workshops (1998, 2005, 2010) the mission area chairs are soliciting technical presentations (presentation required but paper optional) that highlight new technologies, techniques, and facilities for gun propellant burn rate measurement over a wide range of pressures. Previous JANNAF workshops (reports available from the JDOC database and/or the area chairs) have addressed many of the topics for Closed Bombs (CBs) that require to be updated given new challenges we face in layered, deterred, surface-coated, and additively manufactured gun propellants. In addition, the science of felted–fiber NC combustible cartridge cases has not been fully revealed while at the same time new materials for munition cases such as foamed celluloid are arising. Much of the community is starting to rely upon strand burners (SB) as a replacement for the CB, and so arises the question of SB applicability, confluence, and overlap considering CB facilities (i.e., pressure range). The relative ease at which SB samples are prepared and data (including visual) is taken considering pressure range restrictions and/or overlap with CBs is likely to be a popular topic. The organization of a Gun Propellant Burnrate Determination specialist session will be based on the number of presentations received.

Mission Area II:
Solid Propellants and Combustion

Experiment and theoretical studies of solid propellants and their key ingredients are considered in this mission area. These studies can be related to the specific topics listed below.

- Decomposition, Ignition, Kinetics, Combustion, and Extinguishment of Ingredients and Solid Rocket Propellants: Decomposition of ingredients and propellants (including kinetics, mechanisms, microstructure, and thermochemistry of thermal decomposition); ignition of ingredients and propellants (including ignition mechanisms, ignition transients, igniter designs, especially smokeless igniters, and new problems associated with ignition); combustion of ingredients and propellants (including burn rate, pressure exponent and temperature sensitivity, understanding the microstructural combustion zone structure, chemistry, and heat release, effect of motor environment, including spin on combustion, transient burning, combustion of fuel rich propellants, analytical modeling including detailed kinetics studies); hazard initiation of propellants (including inadvertent ignition and effects of high burn rate); methods of extinguishing propellants and implementing thrust termination are considered. Of special interest is how these processes are related to new energetic ingredients and how this knowledge may be used to design new propellants that meet more demanding performance, insensitive munitions, and life cycle requirements. (Papers on thermal decomposition ignition and combustion will be considered for joint CS/ESHS sessions.)
- Failure Analysis of Solid Rocket Motors: Combustion analyses including ignition, flame propagation, burning in cracks and defects, burnback, and flow behavior in support of accident investigations and failure analyses of solid rocket motors are considered. (Papers in this area will be considered for joint CS/ESHS sessions.)
- Solid Rocket Propellant Combustion Instability: Experimental and analytical advancements are considered. Specific topics of interest include: combustion response of low smoke propellants; velocity coupled instability; nonlinear instability; instability at high pressures; motor pulsing; mean flow and acoustics interactions; L* instability; high frequency instability in low smoke motors; combustion response function measurement techniques; and analytical methods for predicting propellant response functions and motor stability.
- Metal Combustion: Behavior of metallic ingredients with special emphasis on nano-particle metals in solid rocket motors is sought. Individual areas of interest include: ignition and burning rate of metal particles or droplets; metal combustion in high density propellants; effects of metal combustion on motor stability and performance; particle phase and size change phenomena; surface melt, agglomeration, and filigree formation; metal combustion in fuel-rich propellants and metal combustion in propellants without ammonium perchlorate; and methods for obtaining in situ particle size measurements.
- Combustion, Prediction, Performance, and Other Topics in Solid Rocket Motor Behavior: Combustion related motor behavior and the application of analytical models, experimental research, and subscale testing to their solution are considered. Areas of interest include: methodology for standardizing experimental measurements,

measurement uncertainties, analytical prediction, computer code verification, correlation, extrapolation, and flight confirmation of performance of solid and liquid rocket, missile and space propulsion systems. Papers on grain design and ballistic modeling are also sought. Behavior in conventional ballistic, tactical, low smoke, controllable, spin-stabilized, ducted, nozzleless motors and gas generators are appropriate subjects for presentation, as are methods for calculating combustion chamber flowfields and their interaction with the motor structural components.

Specialist Session

Joint EPSS/CS Tutorial on Chemical Kinetics

Chemical Kinetics are fundamental to combustion processes that occur within rocket engines, solid rocket motors, air-breathing missiles, and the exhaust plumes they produce. The correct understanding of chemical kinetic mechanisms is essential to accurately predict and characterize combustion performance, energy release, thrust produced, and observable product species. However, discerning the chemical species, reaction mechanisms, and reaction rates that comprise the kinetic mechanism for a given set of propellant reactants is a complex activity that requires the complementary application of computational chemistry techniques and experimental measurements. This tutorial session is intended to present the recent application of computational and experimental methods to determine new or updated chemical kinetic mechanisms of propellants of current interest to the signatures community. The presentations will be made in an open forum format to permit questions during each briefing so as to maximize information exchange and the edification of all attendees.

Mission Area III:
Explosive Performance / Enhanced Blast

Investigations related to detonation and blast performance are sought. Topics ranging from detonation propagation, chemical species formed from the detonation, and combustion processes following the detonation are appropriate for this area. Experimental, theoretical, and computational studies are encouraged that address diverse subjects including; detonation properties, metal driving, enhanced blast, Chem/Bio defeat, target response, underwater blast, and blast protection.

Papers elucidating how new or existing energetic materials and/or novel munitions designs can be exploited are of interest. New experimental techniques, advanced diagnostics and new modeling capabilities that are applicable to the dynamic conditions inherent in detonation events are of interest to this community. Reports of propellant technologies that are applicable to explosive performance are also encouraged.

Of particular interest to this mission area are enhanced blast technologies. Investigations of combustion of detonation products, added fuels, and reactive material dispersal for enhancing blast effects in open-air and various confined structures are sought. Targets of interest include tunnels, caves, multi-room structures, and blast chambers. Papers reporting experimental, theoretical, and computational efforts specifically geared toward understanding the non-ideal, post-detonation energy release phenomena are requested. Papers concerning enhanced blast technologies that exploit novel explosive formulations, non-detonative energetic materials, and munitions designs are of interest.

Specialist Session

High Fidelity Modeling of Reactive Materials: The development of predictive modeling capabilities is required to assess performance and design reactive material (RM) formulations that have the desired chemical and physical properties. Models include continuum mechanics-based predictive code (with input from atomistic and mesoscale submodels) with parameters derived from experimental data obtained from measurements of constitutive behavior as a function of strain, strain rate. The mission area chairs are soliciting technical presentations (presentation required but paper optional) that highlight high fidelity modeling efforts focused on the linkage

between mechanical properties and energy release phenomenology of RM. The organization of a Reactive Materials specialist session will be based on the number of presentations received.

Mission Area IV:
Airbreathing Combustion

Airbreathing Combustion: Theoretical and experimental investigations of subsonic, supersonic, and hypersonic combustion phenomena for airbreathing systems (including small or expendable turbojet engines) are considered. Specific topics of interest include: analytical and experimental (including CFD) determination of combustor flowfield characteristics; connected-pipe testing, freejet testing, and scaling analyses to free-flight conditions; experiments and analyses relating to ignition, mixing and combustion in liquid-fuel, gel/slurry-fuel, and solid-fuel ramjets, gas generator (ducted rocket) combustors, scramjets, and combined cycle engines; the use of ignition and combustion enhancement techniques; studies of liquid and gel/slurry fuel injection, spray formation, vaporization, and combustion processes; the measurement and analysis of combustion instability phenomena; investigation of the formulation, properties, and combustion of high energy-density single- and multi-phase fuels, including boron and other metal-burning slurries and gels; fundamental investigations of airbreathing combustion. (Papers in this area will be considered for joint CS/APS sessions.)

Mission Area V:
Combustion Diagnostics

This area seeks to bring together the non-intrusive flow field diagnostics and computational fluid dynamics (CFD) communities to create an interaction beneficial to both. Papers are sought from the flow field diagnostics community on the development and implementation of new or existing instrumentation relevant to any combustion problem. Emphasis is placed on methods producing data required for code verification. Similar papers are sought from the computational community emphasizing measurement needs and uncertainties required for verification of existing CFD codes. This interaction is expected to result in development of new instrumentation for combustion research, methods designed specifically for high confidence measurements of critical CFD parameters, and new approaches for creating computational models.

Specialist Session

Enhancing Synergy between Flowfield Diagnostics and Computational Modeling: We envision hosting a specialist session which will focus on the benefits of, and desire for, enhancing synergy between flowfield diagnostics and computational modeling. The relationship between diagnostics and modeling is inherently symbiotic. However, we see a gap in communication between the two communities. Developers of diagnostics need to better understand what modelers require (and to what fidelity) to provide useful data. Modelers need to better understand what flowfield diagnostics can offer currently, and how they might be further developed to provide greater value.

We view participation from both the flowfield diagnostics and modeling communities as key, and therefore anticipate inviting speakers representing both communities and advertising the session to attract the targeted audiences. From a diagnostics perspective, practitioners of non-intrusive on-body and off-body diagnostics would be targeted, but not exclusively. Also, although part of the Combustion Subcommittee, we envision this session representing and attracting diagnosticians and modelers across the broader community including combustion/propulsion, aerodynamics, and structural disciplines.

Mission Area VI:
Liquid, Hybrid and Novel Propellants Combustion

This topic area solicits summaries of work planned, underway, or completed to support state of the art and emerging propellant formulation development for evolving, non-traditional mission applications as well as traditional applications. Primary applications of interest are in aerospace propulsion but would also include primary or auxiliary power system application developments reliant upon rapid gas generation.

- Combustion Dynamics of Liquid and Gaseous Rocket Propellants: Theoretical and experimental studies of steady and unsteady combustion phenomena in propulsion systems using liquid or gaseous propellants are considered. Areas of interest include: transient system or process analysis; characterization of the physical and chemical processes involved in combustion; performance, heat transfer, and cooling prediction methods for subcomponents, components, and assemblies including CFD approaches; stability prediction models; development and application of new instrumentation techniques applicable to spray characterization and measurement of species characteristics such as type, distribution, temperature, droplet velocity and evolution to vapor, etc.; subsystem effects on stability; feedback control, or other adaptive methods of stabilizing liquid engines; stability rating techniques; and validity of subscale stability studies.
- Combustion Dynamics of Monopropellant, Bipropellant, and Hybrid Propulsion Systems: Theoretical and experimental studies of steady, unsteady, transition from transient to steady state, and multi-phase combustion phenomena in propulsion systems using liquid monopropellants and bipropellants, liquid oxidizers and solid fuels are considered. Areas of interest include injection, mixing, analytical models of fuel regression rate, chemical kinetics of combustion, ignition system design, and simulation of combustor flows including in applications where these propellants are phase change to gaseous form useable by electric propoulsion devices.
- Combustion Dynamics of Hydrogen Peroxide (HP): Theoretical and experimental studies of combustion phenomena in propulsion systems using HP are considered. Areas of interest include: effect of stabilizers and additives on longevity and reactivity of HP; development of advanced catalysts and catalytic devices for HP decomposition; chemical kinetics of catalysis; direct energy conversion including fuel cells, thermionics, and thermoelectrics; containment strategies mitigating decomposition over time using advanced materials; manufacture and chemical enrichment of HP; and historical usage of HP in propulsion applications.
- Combustion for Underwater Propulsion: Theoretical and experimental studies, numerical modeling, and simulation of steady and unsteady combustion phenomena in propulsion systems for underwater vehicles are considered. Topics of interest include but are not limited to: experimental determination and numerical simulation of combustor flows; underexpanded reacting jets and their mixing, entrainment, and transport characteristics; transients in combustion processes (e.g., kinetics, ignition, quenching, acoustic oscillations in jets, reverse shocks, coherent turbulent structures in fuel-product baths); experimental studies of non- or slowly-reacting similarity systems; combustion similitude, model development, and verification; radiation and other heat transfer effects; behavior of multiphase and multiple, immiscible liquid-phase constituents in combustors; shock, turbulent mixing, and chemical kinetics interactions; and diagnostic measurements, simulation, and combustion instrumentation for underwater propulsion systems.
- Areas of specific community interest: Based upon the Combustion Town Hall Meeting held during the December 2017 JANNAF Conference, this Mission Area anticipates papers on the following topics: green monopropellant ignition and thruster scaling; MON25 thruster performance and stability; MON30/hybrid performance and stability; density-specific impulse increase of green monopropellants; results from the Air Force Research Laboratory Broad Agency Announcement for green monopropellant thrusters; green hypergolic performance & stability; and multi-mode applications.

Specialist Session

The Role of Metadata Approaches in the Advancement of Combustion Applications: Experimental chemical kinetics studies in combustion are of foundational importance, wherein discrete findings may be rationalized using modern ab initio quantum chemical, numerical molecular dynamics, or computational fluid dynamics simulations/theories, and/or other approaches to advance combustion models that cover a wide range of conditions. We are interested in metadata approaches that enrich the utilization of such 'basic' data, with information, which makes it easier to find, use and manage the entire scope of the relevant data domain, so that rapid advancement and fielding of combustion devices can happen.

In this Specialist Session, any area of the work that pertains to the above description will be considered for presentation.

AIRBREATHING PROPULSION SUBCOMMITTEE

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The Airbreathing Propulsion Subcommittee (APS) addresses technical problems and issues associated with turbojet, ramjet, scramjet, and combined- or mixed-cycle engines.

The JANNAF 41st Airbreathing Propulsion Subcommittee sessions will discuss technical problems and issues associated with airbreathing propulsion systems for applications to missiles, launch vehicles, aerospace planes, and remotely piloted vehicles. These include technology, components, and engines within the turbojet, ramjet, scramjet, and combined cycle families. Session topics may include characterization of system performance, engine cycle analysis and testing, engine design, engine/airframe integration, thermal management, fluid and structural mechanics, advanced engine structures and materials, fuel control systems, and characterization of advanced airbreathing fuels. **Topics to highlight:**

Mission Area I:

Turbopropulsion

Subsonic and supersonic aviation applications of turbopropulsion. Specific areas of interest include, but are not limited to: novel cycles and architectures, performance and operability, system-level integration and performance, fuels, aero-thermal structural design and analysis, materials and manufacturing, controls, thermal management, component and system test (on the ground or in flight), and mission performance. Non-aviation turbomachinery papers of interest and application to the broader JANNAF mission will also be considered.

Mission Area II:

Ramjet Propulsion

Ramjets: Papers describing either experimental or theoretical studies related to solid, liquid, and gaseous (ducted rocket) fueled ramjet systems or the constituents thereof are welcome. Authors are welcome to submit papers addressing ramjet and ducted rocket technologies at the component, section, or system level. By example, topics at the component level include techniques for mixing enhancement, active and passive control, plume signature reduction, instability, and testing techniques. Papers describing modeling and simulation studies of ramjets or their subcomponents are encouraged. Fuel development for air-breathing applications continues to be an active area of research within the ramjet propulsion mission area.

Mode Transition: Papers that address mode transition either to or from that of conventional ramjet operation, e.g., boost to conventional ramjet or subsonic to supersonic combustion are welcome. Papers should emphasize the technology that assists in this transition.

Technologies with a Ramjet Application: Authors are encouraged to submit papers that address technologies applicable to ramjet systems, e.g., manufacturing technologies and fabrication techniques, etcetera. Papers need not be associated with a particular system but should be applicable to materials associated with such vehicles and their corresponding flight environment.

Mission Area III:
Scramjet Propulsion

Fundamental and Applied Technology for integrated dual-mode and supersonic-combustion scramjets, components, and subsystems:

- Numerical methods for design, analysis, optimization, uncertainty quantification, and performance assessment, to include CFD, cycle analysis codes, and empirical methodologies.
- Experimental ground and flight tests of scramjet propulsion systems, test facilities and/or infrastructure, including test techniques and advanced measurement systems.
- Techniques and methodologies addressing propulsion system controls, thermal management and their impacts on scramjet operability and performance.

Some papers in this area will be considered for joint APS/CS sessions.

Specialist Session

Hypersonic R&D Overview: Abstracts are requested for an overview session reviewing current activities in hypersonic R&D. Technical papers are not required but may be submitted in addition to the presentations.

Mission Area IV:
Combined / Advanced Cycle Propulsion

Fundamental and Applied Technology: Combined and advanced cycle airbreathing propulsion and engine controls technology and systems. Of particular interest is numerical and experimental research regarding: 1) Aerodynamic, thermodynamic, and structural integration of multiple propulsive cycles and the manner of mode transition between cycles; 2) Methods of broadening the flight Mach number range of gas turbine and dual-mode ramjet cycles to facilitate mode transition; 3) Exploration of airbreathing cycles other than the Brayton cycle; and 4) System-level evaluations to include the choice of fuels, propulsion-airframe integration, and payoff assessments. Papers in this mission area will be considered for joint APS/CS sessions.

Mission Area V:
Integrated Vehicle Design and Analysis

Integrated Vehicle Design: Requesting papers on vehicle designs focused on integrated vehicle performance, trades, and mission applications. Topics of interest include, but are not limited to: vehicle designs, design methodologies, tools, systems integration, subsystem design, and trades/case studies. Additional topics of interest include system/vehicle level thermal management and subsystem design integration. Papers are specifically requested on high-speed airbreathing system design; however, papers on non-airbreathing high-speed vehicles are also welcome. Government only presentations are not desired; however, will be accommodated as needed to protect proprietary design concerns.

- Multidisciplinary Analysis and Design Optimization: Requesting papers on high-speed multidisciplinary analysis and design optimization. Specific topics of interest include, but are not limited to: non-deterministic design approaches, shape optimization, open design framework development, sensitivity/uncertainty analysis, metamodeling, and advances in analysis methods/approaches to reduce design-cycle time. Integrated vehicle and/or subcomponent design optimization and analysis approaches that focus on improving vehicle-level performance in a multidisciplinary framework are highly encouraged.
- Structural Concepts and Airframe/Engine Integration: Structural technologies for enhancing and enabling current and future airbreathing propulsion concepts and systems. Topics of interest include, but are not limited to: TPS and hot structures; structural solutions and technologies related to thermal management, including actively and passively cooled leading edge concepts; general design and analysis methods; considerations for

structural joints and seals, specifically for multi-material interfaces. Papers are specifically requested which focus upon airframe/engine integration concepts and techniques from a system-level perspective.

- Material Development, Fabrication and Manufacturability: Papers are requested that emphasize manufacturing technologies and fabrication techniques. Papers need not be associated with a particular high-speed vehicle system but should be applicable to materials associated with vehicles operating in a high-speed flight environment. Papers on additive manufacturing applicable to scramjets are particularly encouraged. Papers addressing material characterization should make specific reference to intended use cases within a structural concept/component, challenges associated with the eventual integration into a structural system, and anticipated thermal and mechanical loading conditions under intended operating conditions. Papers on materials incorporated in recent or current high-speed flight vehicles are encouraged.
- Multi-Physics Analysis and Experimentation: Papers are requested which emphasize numerical frameworks and/or experimental investigations of compliant structures operating in extreme environments - with respect to both aerothermal and mechanical loading conditions. Papers addressing the challenges arising from integration of a structural component into a structural system are encouraged. Papers are sought which address the coupled interactions between structural deformations and a relevant loading environment. Specific focus should be on the impact of the multi-physics interactions on vehicle performance with respect to specific criteria, such as trajectory/mission requirements - Mach, range, thrust, etc. - or strength and serviceability requirements and useable service life.
- High-Temperature/Extreme Environment Experimental Techniques: Papers are sought which address innovative testing/experimental techniques for use in high-temperature/extreme environment testing regimes. Of specific interest are non-contacting, full-field data acquisition techniques which can be developed and utilized for the generation of validation-quality data sets for this challenging class of problems. Techniques for use in laboratory settings, ground test facilities, as well as those which can potentially be included on flight test vehicles are encouraged.

Mission Area VI:
High-Speed Aerodynamics

Papers are requested covering numerical, experimental and/or flight test efforts focusing on the aerodynamics and aerothermodynamics related to high-speed airbreathing systems, as well as the vehicle's response to loads. Specific topics of interest include, but are not limited to, aerodynamic coupling with the airbreathing propulsion system, the effect of modeling considerations (e.g. chemistry, transition, and turbulence), aerosciences validation and uncertainty quantification, ground test efforts, and aerodynamic-propulsion effects on control surface performance. Additionally, efforts focusing on multi-disciplinary analyses of the aerothermodynamic environment together with vehicle's structural and/or thermal response are welcome.

EXHAUST PLUMES AND SIGNATURES SUBCOMMITTEE

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The 41st JANNAF Exhaust Plume and Signatures Subcommittee meeting will include sessions on phenomena associated with exhaust plumes from rockets, ramjets, space, and gun propulsion systems as well as wakes and hypersonic flows. These phenomena can be divided into three technical areas: plume/wake/hypersonic flowfields, plume/wake/hypersonic signatures (to include electro-optical [EO], infrared [IR], and radio frequency [RF] radiation), and a broad area incorporating other plume/wake/hypersonic effects.

In addition, the EPSS Signatures panel promotes technical interchange among members of the Electro-Optical/Infrared (EO/IR) aircraft/missile signature community from both government and industry.

Instructional Tutorial(s) are solicited. These instructional tutorials are intended to provide the opportunity for each community member to obtain an advanced technical understanding of plume/wake/hypersonic flowfield and signature phenomenology from experts in the field. Each tutorial should be related to a topic listed below. Tutorials should focus on a specific phenomenon or algorithm, provide clear technical instruction, be informative, and carry an academic tone. Tutorials should be limited to two hours or less. Please communicate your interest. **Misson areas and suggested paper topics are listed below.**

Mission Area I:
Plume / Wake / Hypersonic Flowfield Analysis

Papers submitted should be concerned with basic definitions of nozzle and exhaust plume flow fields as well as wake and hypersonic flows. Solid propellant, liquid rocket, and ramjet exhaust plumes will be considered. In addition, plume/wake/hypersonic flow fields at all altitudes will be addressed. Some typical problem areas relating to low/mid-altitude exhaust plumes include external aerodynamic-plume interaction, combustion, turbulent mixing and afterburning, two-phase flow, multi-engine base flow, radiant heating, and oxidizer/fuel gradients. Typical high altitude vacuum plume problems include non-continuum flow, nozzle boundary layer expansion, and condensation. Wake and hypersonic flow problems of interest include ablation mechanisms, flow field modifications caused by outer mold line shape changes due to ablation, and aerothermal heating.

Mission Area II:
Plume / Wake / Hypersonic Radiation and Signatures

Papers are solicited which describe or highlight the following: recent achievements in plume/wake/hypersonic radiation and signatures (to include the EO/IR and RF regimes); plume/wake/hypersonic radiation and signatures related to the generation of vehicle design environments; detection, surveillance, and identification; advancement of theoretical prediction methods; experimental techniques; results of ground and flight measurements; interpretation and correlation of data; any portion of the electro-magnetic spectrum from ultraviolet through longwave infrared to radio frequency (RF) regimes; plume/wake/hypersonic radiation interactions with hardbodies in the RF portion of the spectrum; propulsion systems of all types in terms of thrust level, propellants used, application, and operating altitude; the effects of atmospheric species reacting with chemical constituents in plume/wake/hypersonic flows; plumes in a vacuum; and the effects of atmospheric species on EO/IR/RF signal/signature propagation between an object of interest and an observer.

Mission Area III:

Plume / Wake / Hypersonic Effects

Papers are sought that address the experimental and theoretical characterization of exhaust plume and wake properties as well as their effects such as: impingement pressures and heating for low/high altitude spacecraft vehicle applications, the generation of plume contaminants, the effects of such contamination on vehicle surfaces, and the measurement of plume/wake chemical species concentrations in hypersonic flowfields. Also of interest are papers concerned with convective/radiative base heating due to multi-engine plume interactions.

Mission Area IV:

Additional Plume / Wake / Hypersonic Topics

Other papers dealing with plume/wake/hypersonic flowfield and signature phenomenology and technology that are not covered by the aforementioned areas are invited.

Mission Area V:

Composite Scene Signatures of Plume / Wake / Hypersonic Flowfield and Hardbody Configurations

Papers are solicited for the following topics related to composite scene signatures: EO/IR target signature phenomenology; EO/IR atmospheric transmission/radiation phenomenology and modeling; EO/IR signature target measurements; SPIRITS, FLITES and other signature composite scene codes; SPIRITS target modules; model development and improvements; validation and calibration; applications of signature and scene generation tools to acquisition programs, signature reduction, and operational applications.

ENERGETIC SYSTEMS HAZARDS SUBCOMMITTEE

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The Energetic Systems Hazards Subcommittee (ESHS) is concerned with hazards associated with energetic systems and how these vulnerabilities might degrade system performance and lethality. Included in this scope are hazard analyses for tactical and strategic missiles; small, medium, and large caliber gun systems; solid and liquid propellant systems; hazards encountered during loading and firing operations; and key technology areas identified from hazard analyses. Additionally, ESHS is involved with the development, standarization and application of meaningful computational / experimental methods for assessing vulnerability and performance of the energetic materials found in propulsion systems and munitions. Finally, the subcommittee is concerned with the identification and solution development for interagency problems associated with energetic system vulnerability and performance, the coordination of interagency sponsored programs, the establishment of nomenclature, and the promotion of technical information and data exchange.

The JANNAF 35th Energetic Systems Hazards Subcommittee meeting will address hazards and related technology areas for energetic materials (including propellants, explosives, and pyrotechnics) found in warheads and propulsion systems of munitions. Topics of interest include the identification of potential hazards to energetic systems, the application of meaningful computational / experimental methods for assessing hazard risk, the determination of important hazard technology areas, and the development and standardization of computational / experimental methods for minimizing/mitigating the risk of hazards in relevant systems. Papers are invited that (a) address any aspect of vulnerability and survivability, loading and firing hazards of propulsion systems, and weapon systems safety; or (b) aid in synthesizing, interpreting, and validating current knowledge to make research and development results more useful to the design engineer. Meeting topics generally fall into one of two groups: (1) hazards evaluation or (2) hazards mitigation technology. **Misson areas and suggested paper topics are listed below.**

Mission Area I:
Thermal Decomposition and Cookoff

Mission Area I addresses hazards associated with thermal decomposition and cookoff of energetic materials, ammunition, munitions, and rocket motors.

- ***Thermal Decomposition, Ignition, and Combustion:*** Fundamental experimental and modeling studies of thermal decomposition of reactive materials including EM ingredients and formulations; changes in reactivity from autocatalytic, self-heating and confinement effects; thermal ignition of EMs; and combustion of EMs in off-design scenarios. (Papers in this area may be considered for joint ESHS/CS sessions.)
- ***Thermally-Induced Damage Effects:*** Research related to thermally-induced damage with the potential to produce changes in burning rate and material sensitivity with implications for both safety and performance. Studies of the creation, measurement, and assessment of thermal damage in EMs and the associated safety and/or performance effects are encouraged. (Papers in this area may be considered for joint ESHS/CS sessions.)
- ***Cookoff Hazards Assessment and Mitigation:*** Cookoff response of energetics systems and components; cookoff mitigation technologies; threat/hazards assessment (THA) of cookoff scenarios; relationships between THA and cookoff test procedures; small scale test methodologies for predicting cookoff of full scale systems; effects of heating rate on cookoff response.
- ***Thermal and Combined Environments:*** Hazards from thermal environments produced in operational and accident scenarios. This may include experimental and modeling studies of the environments themselves

(e.g. aerothermal heating, fire, etc.) and the response of energetic systems (propellants, explosives) to those environments. Effects of combined mechanical/thermal environments produced by accident scenarios (e.g. crash-and-burn) and advanced delivery systems (e.g. g-force, vibration + aerothermal) are also of interest.

Mission Area II:
Shock / Impact-Induced Reactions

Mission Area II is focused on chemical reactions in energetic materials resulting from either strong or weak impacts. These chemical reactions may result in a detonative response (e.g., a shock-to-detonation transition [SDT]) or a sub-detonative event (e.g., deflagration).

- ***Energetic Materials Testing:*** The development and use of shock sensitivity tests such as gap testing, as well as material characterization experiments (e.g., gas gun experiments and wedge tests).
- ***Modeling and Simulation:*** In addition to energetic material testing, topics related to model development and simulations used for predicting the energetic material's response to stimulus and impact.
- ***System Performance and Lethality:*** Finally, system performance and lethality data necessary for model validation and improved characterization of energetic impact events are of interest

Mission Area III:
Insensitive Munitions Technology

Mission Area III supports advances in technologies to reduce or eliminate violent response by a munition when exposed to unintentional stimuli, such as fast or slow heating, bullet or fragment impact, or shaped charge jet impact.

- I***M Technology:*** Historical reviews of prior IM technology developments and lessons learned from integration into munitions, ongoing development efforts both general and specific to systems/munitions, design and functional details of passive and active mitigation concept, results of IM and Safety testing of components and complete systems, and eveluationevaluation of the relationship between small-scale and full-scale testing.
- ***Emerging Issues:*** New IM concepts, design trade-off studies, novel computational methods, leveraging different computational methodologies for RDT&E, new and emerging threats, new and/or revised experimental test and evaluation methodologies/analyses, updates to the NATO IM Portfolio, and harmonization of tests/analyses such as the new Insensitive Munitions - Hazard Classification (IM-HC) AOP-4864.

Mission Area IV:
Combustion Vulnerability of Stowed Energetics

Mission Area IV focuses on the response of onboard energetic materials—including fuels, batteries, refrigerants, and stowed munitions—to an ignition source (e.g., shaped charge jet).

- ***Stowed Energetic Response:*** Detonation, deflagration, or detonation to deflagration (DDT) reactions or burning of any vehicle based energetic system (i.e., fuels used for propulsion, hydraulic oils, lubricants, stowed propellants and ammunition, Li-ion batteries, refrigerants, etc.) when subjected to an ignition source.
- ***Experiment Methodologies:*** Data collection, analysis and results and modeling and simulation, included but not limited to vulnerabilities to vehicle platforms and mitigation solutions, sympathetic detonation, response of vehicle energetics to overmatching ballistic threats, and characterization of non-conventional energetic materials.

Mission Area V:
Safety and Hazard Classification of Solid and Liquid Energetics

Mission Area V addresses explosives safety siting and hazard classification for DoD ammunition and explosives, small arms, CAD/PAD, rocket motors, warheads, bombs, energetic liquids, and any system that contains energetic materials:

- ***Propulsion Systems Safety and Hazard Classification:*** Harmonization of hazard classification and insensitive munitions testing, issues identified by the service safety offices, hazard classification issues, differences between insensitive munitions and hazard classification and safety testing and standardization, assessment of response and pass/fail criteria, alternate test protocols and the role of small scale to full scale testing and hazard classification, and miscellaneous safety issues and programs.
- ***Hazard Classification of Large Solid Rocket Motors:*** Test methods/procedures, analysis techniques, experimental data and computer simulation results related to the assessment of hazard response of large solid rocket motors for hazard classification purposes. In particular, papers covering three hazard scenarios are of interest, including: (1) detonation/explosive reaction characteristics of various propellant families subjected to explosive shocks, for example critical diameter, shock sensitivity, and the relationship between the two parameters; (2) response of large SRMs in an engulfing fire or fast cookoff scenario; and (3) criteria and effects of propellant damage on hazard response of large SRMs in impact and other accident scenarios.
- ***Energetic Liquids, Hypergolics and Gels:*** The Department of Defense Explosives Safety Board establishes criteria for the hazard classification and siting of energetic liquids, hypergolics and gels DESR 6055.09. These criteria were last updated in the late 1990's. Current space initiatives require new energetic materials and new combinations of existing materials. These materials in new configurations require improved/new tests and methods for hazard classification. They also, require approaches for siting a variety of configurations, concentrations, purity, etc. Alternative test methods, the role of small scale to full scale testing for hazard classification, modelling and miscellaneous safety issues need to be determined and evaluated

Mission Area VI:
Energetic Defect Characterization

Mission Area VI supports ongoing work in the energetics community performed by the DoD, DOE, and others to evaluate and predict the effects of defected energetic materials in extreme environments such as launch, hypersonic flight, and target impact.

- ***Defect Parameterization and Criticality Deduction:*** Defect detection and determination; munition and energetics inspection; X-Ray and XCT SOPs and specifications; characterization of defects by type, parameter, and location.
- ***Testing and Evaluation:*** New/novel experimental methodologies, SOPs, and equipment; new/novel computational methodologies, codes, and software; applicable sub-scale evaluation techniques for defect characterization; time scales and granularity of defect parameter analyses.

MODELING AND SIMULATION SUBCOMMITTEE

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The Modeling and Simulation Subcommittee (MSS) provides an overarching focus on M&S across all disciplines related to JANNAF Interagency simulation-based acquisition include propulsion systems for aerospace plane, hypersonic aircraft, rocket-based space-access systems, high-speed missiles, in-space propulsion systems, and gun propulsion systems. MSS mission areas of Model-Based Engineering; Integrated Health Management; Simulation Credibility, and Model Based Test and Evaluation. MSS is focused on these topics, seeking to advance modeling and simulation capabilities for the propulsion community.

The 19th Modeling and Simulation Subcommittee (MSS) provides an overarching focus on M&S across all disciplines related to JANNAF Interagency simulation-based acquisition of propulsion systems for aerospace plane, hypersonic aircraft, rocket-based space-access systems, high-speed missiles, in-space propulsion systems, and gun propulsion systems. The MSS pursues this focus through Model-Based Engineering (MBE), Integrated Health Management, Simulation Credibility: Verification, Validation, and Risk, and Model Based Test and Evaluation. At the 19th MSS Meeting, papers are sought to address specifics of the mission areas as described below. Questions about any of the MSS mission areas should be directed toward the JHU WSE ERG Technical Representative for MSS. **Misson areas and suggested paper topics are listed below.**

Mission Area I:
Model-Based Engineering

Model-Based Engineering (MBE) encompasses the development of methodologies, codes, and model simulations to quantitatively evaluate and optimize propulsion technologies across propulsion component, propulsion system, and vehicle system levels. The MBE mission area includes the specific discipline of Model-Based System Engineering (MBSE). MBSE is the formalized application of modeling to support system requirements, design, analysis, and verification/validation activities from conceptual design through later life cycle phases. The use of models complements traditional experimentation during technology development with a goal of reducing the development time and schedule. Development and usage of physics-based models allows exploration of domains and behaviors that may be particularly difficult or impossible to examine experimentally. Statistical models provide an estimation of system sensitivities and uncertainties. Publications in the MBE area fall under two topic headings: Modeling Methodologies/Approaches/Tools and System Analysis Results.

Examples of topics of interest for the MBE mission area include the following:

- Modeling Methods/Approaches
  - » Proposed performance/loss models for rotating detonation rocket engines
  - » Ignition Modeling
  - » Accommodating multidisciplinary modeling at multiple heterogeneous levels of fidelity
  - » Engineering decision support, including facilitating optimization, scheduling, and knowledge-based tool integration into the engineering process
  - » Advances in the development of models and methods for component modeling and simulations to aid propulsion design
  - » Improvements in commercial software which enable advanced MBE

- » Challenges/Boosts to using MBE under a more commercial/less centralized propulsion technology development paradigm and shifts from horizontal to vertical integration in the launch industry
- » AI-based approaches for improving system modeling and design, including (but not limited to) learned reduced-order simulations, design optimizations, active learning for optimizing test case efficiency, differentiable simulations, and generative AI designs.

- System Analysis Results
  - » M&S of vehicle system technology trades for space launch systems, prompt strike platforms, long-range ballistic missiles, cruise missiles, and hypersonic cruise vehicles
  - » Simulations, methods, and models to evaluate performance capabilities, cost, and reliability of systems
  - » Simulations, methods, and models to evaluate AI-in the loop vehicle systems
  - » Vehicle and launch facility, weapon and weapons platform, propulsion system and test facility simulations, interactions, and integration

Mission Area II:
Integrated Health Management

MIntegrated Health Management (IHM) promotes advancement and development of best practices of health management of propulsion systems within a "system of systems" environment. IHM technologies are focused on reducing maintenance and logistics costs, and increasing reliability of propulsion systems. IHM includes methods and tools for a variety of technologies: data management and mining; integrated communications, command and control; diagnostics; prognostics, and integrated sensors and sensing systems. These tools enable making redline and contingency decisions using knowledge-based expert systems, model-based diagnostic and reasoning using physics-based or advanced empirical models such as first-principles, fault models, machine learning and artificial intelligence (AI), neural networks, fuzzy logic, genetic and evolutionary algorithms, and life-cycle analysis. The advancement of the internet of things (IoT), digital twin and augmented reality (AR) technologies are key enablers for implementing IHM systems in propulsion systems.

Seeking papers on the following, with the intent to establish a valuable interchange of technical solutions:

- Condition evaluation of Propulsion Systems relevant IoT and AR implementation challenges, successes, lessons learned and business case impact
- Digital Twin application examples and practices for propulsion systems supporting reliability or readiness
- Data Management and Mining: Advances in data mining, data fusion, machine learning, and statistics with applications to verification and validation of data, prognosis and diagnosis of system health
- Integrated Communications, Command and Control: architecture, theory, test beds, and demonstrations focused on vehicle health or reusability
- Diagnostic Systems: architecture, theory, simulations, and demonstrations of diagnosis of current state of health of propulsion and vehicle system, including in-place and depot-level non-destructive inspection methodologies
- Prognostic Systems: architecture, theory, simulations, and demonstrations of prognosis of future state of health of propulsion and vehicle systems; mitigation of, and recovery from, degraded system health to enable condition-based repairs and successful missions
- Integrated Sensors and Sensing Systems: diverse sensors and integrated sensing systems with broad applications to health and status monitoring of all vehicle types and methods for integrated sensing systems across multiple disciplines and end-use applications with an emphasis on measurement technology, smart sensors, test beds, application considerations, lessons learned, and sensor fidelity for condition-base maintenance (CBM+) of propulsion systems

Mission Area III:
Simulation Credibility: Verification, Validation, and Risk

The credibility of digital and analog simulations is a major issue for incorporating simulation tools and data into a technology-development program, for conducting simulation-based acquisition, for assessing system reliability to assure human safety and/or mission success, and for identifying and assessing risks in complex, technological systems. Simulation credibility includes assessment and management of computer simulation uncertainty, experimental uncertainty, verification and validation (V and V) of simulation models and of simulations, and risk assessment. Abstracts are solicited on technological advances in the following areas:

- Uncertainty quantification for experiments and simulations
- Validation of models and verification of simulations
- Propagation of uncertainty
- Risk assessment and management
- Recommendations for guidelines, procedures, or standards

Mission Area IV:
Model Based Test and Evaluation (MBTE)

Model Based Test and Evaluation (MBTE) investigates the design, development, and use of different types of models (e.g., logical, physical, virtual, etc.) to compliment physical testing of propulsion systems. MBTE technologies are expected to increase the linkages between test models and systems under test (SUT), facilitate a higher degree of test process automation (e.g., reporting), and provide greater accuracy regarding predicted results of test through the use of high-fidelity physics based models, virtual prototypes, and digital twins.

The following topics represent strong alignment with this mission area:

- Model-Based Test Engineering: Test methodologies using models to capture requirements, behavior, structure, and functionality of propulsion SUTs and/or associated propulsion test infrastructure
- Verification & Validation: Models used to perform verification, validation, and uncertainty quantification for propulsion SUTs and/or associated propulsion test infrastructure
- Data Architecture and Modeling: Models used to define, develop, and deploy propulsion test and evaluation data pipelines for process automation and improved data analytics
- References & Standards: Definition and development of model-based plans, processes and procedures used to streamline propulsion test and evaluation
- Reality Capture: High-resolution models used to represent test equipment, test fixtures, test facilities, and test installations used for propulsion test and evaluation
- Modeling Simulation and Analyis (MS&A): High-fidelity physics based models used to represent real-world phenomenon associated with propulsion SUTs and/or associated propulsion test infrastructure
- Digital Twins/ Digital Threads: Application models and software developed to serve as digital twins and associated digital threads for propulsion SUTs and/or associated propulsion test infrastructure
- Virtual Prototype Testing: Model based tools and techniques to support virtual experimentation and testing of propulsion SUTs

POSTERS

POSTER SESSION INFORMATION

For the June 2025 Meeting, abstracts for poster presentations may be submitted by any interested author, including those considered Early Career professionals. The poster sessions will take place on T**uesday, 10 June** at the Spokane Convention Center and will be open to all meeting attendees. All Posters must be unclassified and suitable for public release or approved for presentation at distribution statement C/CUI/FEDCON. Authors of abstracts selected for Poster presentations have the option of providing a paper.

Early Career Posters

JANNAF is interested in offering more opportunities for Early Career Propulsion and Energetics Professionals to engage with one another and the overall JANNAF community. In order to be considered an Early Career Professional, at least one of the following criteria must apply to you:

- A student
- Working in the field for less than five years
- Have obtained your Doctorate within the last five years

If you meet the above criteria of an Early Career professional, you are eligible to submit a poster abstract for any of the subcommittees listed on pages 8-28. When submitting, choose “Early Career Poster” in place of selecting a Mission Area within your preferred subcommittee.

General Posters

Authors interested in presenting a Poster who do not meet the JANNAF definition of Early Career have the option of selecting “General Poster” in lieu of choosing a Mission Area when submitting an abstract. The preferred subcommittee must first be selected so that the identified subcommittee is assigned the Poster abstract for review.

Visit the Poster Information page for additional details.

WORKSHOPS/SPECIALIST SESSIONS

Recommendations for workshops or specialist sessions are solicited at this time. Individuals interested in organizing and chairing a workshop or specialist session should contact the JHU WSE ERG Technical Staff member in their respective subcommittee by the Deadline of **31 January 2025**.

Workshops

The JANNAF Workshop is reserved for bringing the community together to address a specific task or problem, the outcome of which is important and substantial enough to warrant the publication of a final report detailing the discussions, conclusions, and recommendations that resulted from the workshop.

To request a workshop you must submit a Workshop Request Form to your JHU WSE ERG Technical Representative (see pages 8 - 28 for contact information) or the JANNAF Meeting Planning Team at meetings@erg.jhu.edu. This form must be submitted to ERG by **Friday, 31 January 2025**. The agenda and invitation list is due **Friday, 14 March 2025** for inclusion in the Preliminary Program, and must be approved no later than **Friday, 11 April 2025** for inclusion in the Final Program.

Specialist Sessions

A JANNAF specialist session is an opportunity for experts in a specific technical area to meet to stimulate ideas and contributions from the audience. These sessions are dedicated to a single topic and often include invited presentations. The organization of these sessions is similar to a regular JANNAF paper session with time allocated to individual presentations; however, specialist sessions often include moderator led discussion periods or a question and answer session with expert panelists. Unlike a regular JANNAF paper session, the presentations from specialist sessions may or may not be published as part of the meeting proceedings. Publication can include an executive summary authored by the session chair if desired.

To request a Specialist Session for this JANNAF meeting, a Specialist Session Request Form must be submitted to JHU WSE ERG. This form requires a statement of justification for the Specialist Session along with a well thought out agenda. Requests will be reviewed by the designated JANNAF subcommittee TSG chair and ERG for approval; this approval is necessary for any Specialist Sessions to be included in the Final Program.

The deadline for submission of a Specialist Session request is **31 January 2025**, and forms must include a draft agenda. In order for the draft agenda to be included in the Preliminary Program, all Invited Presentation details must be submitted online via the Abstract Submittal Site no later than **Friday, 14 March 2025**. To be included in the Final Program, the final agenda and online submission of all Invited Presentation details must be received no later than **Friday, 11 April 2025**. If you have any questions about planning a Specialist Session please contact your ERG Technical Liaison or the JANNAF Meeting Planning Team at meetings@erg.jhu.edu.

UPCOMING JANNAF MEETINGS

72nd JANNAF Propulsion Meeting
Programmatic and Industrial Base Meeting
53rd Combustion
41st Airbreathing Propulsion
41st Exhaust Plume and Signatures
35th Energetic Systems Hazards
19th Modeling and Simulation
Joint Subcommittee Meeting

9 - 13 June 2025
Spokane, Washington
Visit June 2025 meeting website

15th Liquid Propulsion
14th Spacecraft Propulsion
Joint Subcommittee Meeting
Programmatic and Industrial Base Meeting

8 - 12 December 2025
Location TBD

73rd JANNAF Propulsion Meeting
Programmatic and Industrial Base Meeting
50th Structures and Mechanical Behavior
46th Propellant and Explosives Development and Characterization
35th Safety and Environmental Protection
20th Modeling and Simulation
Joint Subcommittee Meeting

Spring 2026
Location TBD