JANNAF INTERAGENCY PROPULSION COMMITTEE
JOINT ARMY-NAVY-NASA-AIR FORCE

ANNOUNCEMENT & CALL FOR PAPERS

71st JANNAF Propulsion Meeting (JPM)
Programmatic and Industrial Base Meeting (PIB)
18th Modeling and Simulation (MSS)
14th Liquid Propulsion (LPS)
13th Spacecraft Propulsion (SPS)
JOINT SUBCOMMITTEE MEETING

6-10 MAY 2024 // OKLAHOMA CITY, OKLAHOMA

Abstract Deadline: 1 December 2023

Courtesy of DARPA

last updated 11/13/2023

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The May 2024 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) will consist of the Joint Meeting of the 71st JANNAF Propulsion Meeting / Programmatic and Industrial Base Meeting / 18th Modeling and Simulation / 14th Liquid Propulsion / 13th Spacecraft Propulstion Joint Subcomittee Meeting. Ms. Christina A. Blankenship with DEVCOM Aviation & Missile Center at Redstone Arsenal, AL, is the Meeting Chair. This meeting will be held **Monday through Friday, 6 - 10 May 2024**, at the **Sheraton Oklahoma City Downtown Hotel in Oklahoma City, Oklahoma**. Please refer to page 5 for hotel and area information.

ATTENDANCE REQUIREMENTS

The following information is applicable to all attendees, including presenters. The overall security level of the meeting is **Unclassified**. All sessions will be held at the **Sheraton Oklahoma City Downtown 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.*

ALL non-government attendees (which includes contractors, consultants, and universities) attending this meeting **must:**

1. Be working on a current government contract or certified by a Sponsoring Government Official
2. Provide their organization'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/.

ALL Attendees: To register, you must first have a JANNAF Secure Portal account. Please visit the Registration Steps page of the meeting website for additional information and important links. *All presenters are required to register and pay the registration fee.*

University Participants: Students and professors must meet additional requirements, as outlined on the University Registration Information page of the May meeting website.

Questions concerning attendance eligibility should be directed to the JANNAF Assistant Security Officer, Mionna Sharp (msharp@erg.jhu.edu) or by calling (410) 992-7300 ext. 224.

REGISTRATION

Registration will open in late-February. Preliminary information is provided on the May meeting website with full details available when registration opens.

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.

Work in all areas of DoD and NASA are solicited as defined below:

6.1 Basic Research:
Systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products.

6.2 Applied Research:
Systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

6.3 Development:
Systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

JANNAF accepts papers that are unclassified/unlimited and unclassified/limited for all meetings; and up to classified Secret as indicated in the specific meeting's announcement and call for papers.

SCOPE

To learn more about the scope of the standing JANNAF subcommittees at this meeting, please review the information provided below and on pages 6 - 15.

JANNAF Propulsion Meeting

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 71st JPM in 2024 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.

Programmatic and Industrial Base Meeting

The JANNAF Programmatic and Industrial Base (PIB) Committee was created with the approval of the JANNAF Charter by the Department of Defense and the National Aeronautics and Space Administration in 2014. Its focus is on providing a mechanism for DoD and NASA 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.

Modeling and Simulation Subcommittee

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 Modeling and Simulation of System Autonomy. MSS is focused on these topics, seeking to advance modeling and simulation capabilities for the propulsion community.

Liquid Propulsion Subcommittee

The 14th LPS is seeking papers on the advancement of liquid engine systems, technical problems and issues associated with design, analysis, fabrication, and testing, including liquid and gel propulsion as well as rotating detonation rocket engine technology topics that include the overall engine system, combustion components, turbomachinery and propellant feed systems.

Spacecraft Propulsion Subcommittee

The charter of the Spacecraft Propulsion Subcommittee addresses technical problems and issues of national needs associated with technology materials applied to space-based primary or auxiliary propulsion. These issues (for both system and component level) include design, development, materials, lifetime, performance, ground testing, flight testing, validation, qualification, spacecraft integration, fabrication processes, standards and cost. The 13th SPS seeks abstracts on the full array of spacecraft propulsion technology interests including chemical propulsion, electric propulsion, micropropulsion, nuclear thermal propulsion, propellant management, aerocapture, solar sails, solar thermal propulsion, tether systems, in-space propulsion infrastructure, and technologies for the future. Possible applications to these technologies are orbit to orbit transfer, attitude control, non-terrestrial ascent/descent, station keeping, deep space, formation flying, drag makeup, and orbital rephasing.

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 6 - 15.
- Remember, y***ou must be a qualified U.S. Citizen to attend and present at this meeting***. No foreign nationals are permitted to attend.
- **The deadline date for submission of the online Abstract Form is 1 December 2023.** Please do not submit late without first contacting ERG (meetings@erg.jhu.edu).
- **Many organizations require abstracts to be processed through an approval system prior to submission. This process takes additional time, so authors should plan accordingly in an effort to meet the abstract deadline date.**
- Submitting an abstract represents an agreement to **submit a final paper for publication by 5 April 2024,** attend the meeting, and deliver a 25-minute presentation. The JANNAF Policy of "No Paper, No Podium" will be in effect for this meeting.
- **All abstracts are to be submitted via the JANNAF Abstract Submittal Site**. A JANNAF Portal account is not required to submit an abstract.
- The **content of all abstracts must be unclassified and either distribution statement A** (approved for public release) **or C** (Distribution authorized to U.S. Government and their contractors), regardless of the eventual classification and distribution statement of the paper and presentation.
- **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. This important information helps the program planning committee to properly place your presentation if accepted.
  - ▹ 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. DoD 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 is limited to 150 characters including spaces.
- A maximum of five (5) authors may be listed for inclusion in the author list for the Preliminary and Final Programs. You may list more than five 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 in the online form 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 cannot be submitted via email, and instead 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 whether or not you have an active JANNAF Secure Portal Account. A "Help" button is provided at the upper right corner of each page should you require assistance.
   a. **If you DO NOT have an active JANNAF Secure Portal Account,** click the link, "I do not have a JANNAF Portal account and wish to submit an abstract." Then proceed to step 2 in these instructions.
   b. **If you have an active JANNAF Secure Portal Account,** click the link, "I have an active JANNAF Portal account and wish to submit an abstract." You will be prompted to log into your account (if you have not already done so), and directed to the Abstract Landing Page. Skip ahead to step 3 in these instructions to continue.
2. After clicking the link indicating that you DO NOT have a JANNAF Portal account, you will be taken to a page prompting you to begin a validation process to ensure the legitimacy of your submission(s).
   - ► Select the appropriate meeting (May 2024 JPM/PIB/ MSS/ LPS/ SPS) and complete all required fields. Remember the email address that you have entered, as you will need it for later steps. After completing all fields, click the "Request" button at the bottom of the page. You will be provided instructions to guide you through the remaining validation process.
   - ► If you have not received a validation code (from info@erg.jhu.edu) within 30 minutes after you have submitted a request, email meetings@erg.jhu.edu. Be sure to check your junk/spam folder.
   - ► You may use your validation code to submit more than one abstract.
3. After reaching the Abstract Landing Page, click the grey "Abstract Submissions" 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.
4. When all required fields have been completed accurately, submit your abstract. You will have the opportunity to review your responses before you submit.
5. If you would like to edit a draft or submit another abstract, return to https://jannaf.org/abstractstart.
   - ► **If you DO NOT have an active JANNAF Secure Portal Account**, select the option, "I do not have a JANNAF Portal account but already have a validation code." Re-enter the email address and validation code that you used previously in order to access these options.
   - ► **If you have an active JANNAF Secure Portal Account,** repeat step 1b, and steps 3 – 4.

RECOMMENDATIONS FOR WORKSHOPS OR 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 with suggestions for topics by **1 December 2023**. See page 16 for additional information and requirements.

AWARDS

Nominations for JANNAF Technical Executive Committee (TEC), PIB Executive Committee (PEC), MSS, LPS, and SPS recognition awards are being solicited. Individuals interested in nominating an award recipient should follow the guidelines and instructions on pages 16 – 17.

Some top reasons given for attending JANNAF meetings:

- The opportunity to present limited distribution papers to a technical audience and collaborate with colleagues from other laboratories and companies.
- Networking opportunities with other scientists.
- Lessons learned presentations.
- Keeping up with changing technology.
- Wide variety of subjects.
- Great exposure to the industry for young professionals.

HOTEL & AREA INFORMATION

Sleeping rooms have been contracted with the Sheraton Oklahoma City Downtown in Oklahoma City, Oklahoma where all sessions will be held. Top nearby attractions include the Oklahoma City National Memorial and Museum, Scissortail Park, and the Bricktown Entertainment District. A wide variety of dining options are within a short walk or street car ride.

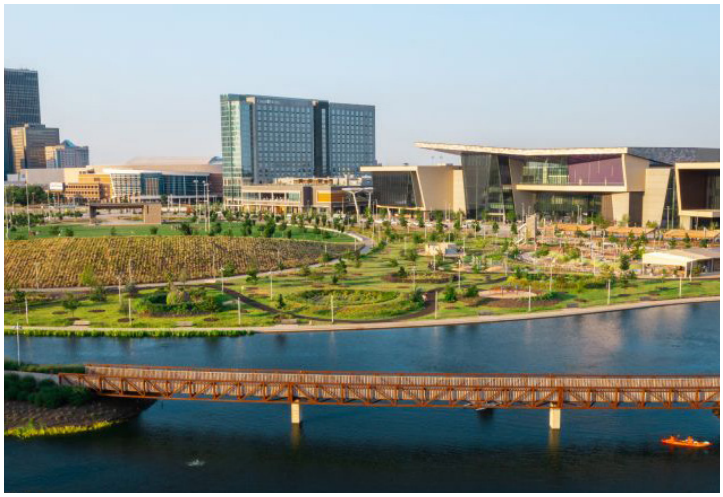
Hotel

Discounted rooms at the Sheraton Oklahoma City Downtown will be available at the Oklahoma City GSA FY 2024 per diem rate of $110. This rate is for single or double occupancy and is subject to state and local taxes, currently 14.125%.

More information and the links to reserve your room in the JANNAF discounted room blocks will be posted on the Hotel page of the May meeting website when the Meeting Invitation and Preliminary Program have been posted online, and registration has been opened.

Transportation

The Will Rogers World Airport is 10 miles/15 minutes from the hotel. The Sheraton Oklahoma City Downtown does not offer airport shuttle service. Ground transportation costs are approximately $14-20 for a taxi or rideshare from the airport to the hotel. More information can be found on the airport's website. Rental cars are available at the airport, and self-parking at the garage adjacent to the hotel is discounted at $8/day for JANNAF attendees. The Oklahoma City Streetcar stops just steps from the hotel's front entrance and is your gateway to exploring Oklahoma City for just $1/ride or $3 for a day pass.



JPM/PIB/MSS/LPS/SPS AUTHOR TIMELINE

Date (subject to change)	Weeks before Meeting	Action
1 Dec 2023	22	Deadline for receipt of abstracts via Abstract Submittal Site.
26 Jan 2024	14	Committee decision emails sent to authors.
2 Feb 2024	13	Deadline for changes to Meeting Invitation and Preliminary Program.
26 Feb 2024	10	Meeting Invitation, Preliminary Program, and registration materials forwarded to propulsion community.
1 Mar 2024	9	Deadline for award nominations and submittal of Student papers for Best Student Paper award consideration.
22 Mar 2024	6	Deadline for submission of changes to the Final Program.
5 Apr 2024	4	Deadline for discounted Early registration fee
5 Apr 2024	4	Deadline for receipt of papers and publication clearance forms. **Papers not received by this date may be removed from the program.**
19 Apr 2024	2	Deadline for reservations at host hotel.
19 Apr 2024	2	Deadline for receipt of presentations.
19 Apr 2024	2	Last day to pre-register online - complete both the registration form and payment of registration fee by this date. On-site registration required thereafter (allow extra time on-site).
6 May 2024	0	Start date for JPM/PIB/MSS/LPS/SPS Joint Subcommittee Meeting

SUBCOMMITTEES / MISSION AREAS AT THIS MEETING

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

Mission Area	JPM	MSS	LPS	SPS
I	Tactical Propulsion	Model-Based Engineering	Liquid Engine Systems	Chemical Propulsion
II	Missile Defense / Strategic Propulsion	Integrated Health Management	Liquid Combustion Subsystems and Components	Electric Propulsion
III	Propulsion Systems for Space Access	Simulation Credibility: Verification, Validation, and Risk	Liquid Propellant Feed and Pressurization Systems	Cube/Nano Satellite Propulsion
IV	Gun and Gun-Launched Propulsion	Modeling and Simulation of System Autonomy	Advanced Materials for Liquid Propulsion Applications	Future Technologies
V	Propulsion and Energetics Test Facilities		Rotating Detonation Rocket Engines	
VI	Sensors for Propulsion Measurement Applications		Propulsion-Induced Environments and Structural & Thermal Loads	

JANNAF PROPULSION MEETING (JPM)

The 71st 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

Does Your Abstract Need to be Approved before Submitting?

Many organizations require abstracts to be processed through an approval system prior to submission. This process takes additional time (in some cases, as much as 6 weeks), so authors should plan accordingly in an effort to meet the 1 December abstract deadline date.

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.

JHU WSE ERG Technical Representatives

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MODELING AND SIMULATION (MSS)

The 18th 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 Modeling and Simulation of System Autonomy. At the 18th 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.

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
- 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
  - Vehicle and launch facility, weapon and weapons platform, propulsion system and test facility simulations, interactions, and integration

Mission Area II: Integrated Health Management

Integrated 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: Modeling and Simulation of System Autonomy

Modeling and Simulation of System Autonomy encompasses the development of methodologies, codes, and models, and simulations to evaluate, analyze, and optimize autonomous system capabilities. This includes the modeling and simulation of artificial intelligence (AI) algorithms, the integration of AI algorithms, simulation environments including the interaction of algorithms with system hardware, verification and validation of non-deterministic algorithms, and determination of operational bounds. The use of modeling and simulations of autonomous systems to determine their responses and operational bounds is also a crucial technology area. Various autonomous systems are included in this mission area including air launched systems, ground vehicle launched systems, hypersonic vehicles, launch vehicles, spacecraft, and water launched systems. Specific topics of interest include impact of autonomous system responses to propulsion system performance, autonomous algorithm test and characterization methodology and test sets, integration of sensors suites with autonomous algorithms, and autonomous launch system interaction with launch vehicles and missiles.

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LIQUID PROPULSION (LPS)

The JANNAF 14th Liquid Propulsion Subcommittee meeting will include sessions in five general technical areas: liquid engine systems; liquid combustion subsystems and components; liquid propellant feed and pressurization systems; advanced materials for liquid propulsion applications; and rotating detonation rocket engines. Papers are solicited that will aid in the design, development and test of efficient and stable liquid propulsion systems. Please contact the JHU WSE ERG Technical Representative for LPS with questions about the LPS mission areas.

Mission Area I: Liquid Engine Systems

System Models and Data Integration: Analytical tools, system models, and methodologies that support digital engineering throughout the liquid engine lifecycle. Specific interest in analyses or data integration that enable greater comprehension of system interactions and dependencies; Model-Based Engineering (MBE) architectures, design verification and traceability, risk and margin management, test data analysis, and prediction of integrated-system performance, mass, and cost.

Operability, Serviceability, and Reusability: Research associated with rapid operations, maintenance, and increased asset life. Architecture Con-Ops, functional analysis, and designs that improve the efficiency of launch operations or develop a capability for in-space operations.

- Operability and Serviceability - technologies and designs that increase automation, provide resilient/launch-on-demand capabilities, or enable use over a wider range of launch environments and applications. This can include technologies to address rapid or minimized cleaning/inspection, integrated diagnostics, ability to field remove-and-replace, or approaches to improve launch availability.
- Modularity - Engine architectures, technologies, and designs that increase the applicability of unique propulsion systems across small, medium and large launch vehicles (scalability), applicability to various mission sets (Commercial launch, Rapid Launch, etc.). Furthermore, approaches to dramatically reduce development timelines and amortize cost by increasing economies of scale of liquid rocket engines.
- Reusability - Engine designs for high rate flight operations, long in-space missions; 25+ engine firings, refueling operations, system diagnostics, and servicing of critical components.

Liquid Engine Systems for Small Launch Stages & Landers: Design, development, test, and evaluation approaches for liquid propellant rocket engines applicable to small landers and launch vehicle stages: reliability, fabrication, testing, operations, and the affordable integration of those areas. Systems that enable autogenous pressurization, deep throttling capability, cryogenic RCS, or wireless instrumentation and controls are of particular interest. Development strategies that enable integrated stage testing, flight testing, and certification of flight systems are also of interest.

Liquid Engine Systems for Human-Rated Stages & Landers: Design, development, test, and evaluation strategies for liquid propellant rocket engines applicable to human-rated vehicles; including Lunar and Mars landers, Nuclear-Thermal propulsion, commercial space applications, and NASA's Space Launch System (SLS). Functional requirements and design concepts and/or design modifications for the engines on these vehicles. Advanced methods for fabrication, assembly, and inspections. Plans and programs for conducting integrated stage ground and flight testing. Approaches for meeting government (NASA, FAA, or OCST) safety and reliability requirements for operation with crew and passengers, including fault tolerance, fault detection, isolation, and recovery; crew interaction, reliability predictions and models, and qualification/certification testing requirements and approaches.

Liquid Rocket Engine (LRE) Development History: Papers addressing the important process which LRE have gone through in the course of their development. Particular subjects of note are successes, failures, mishaps, and lessons learned. Topics can be detailed in their information or can provide a general overview of the program. Papers are not limited to flight systems; testbeds, proof-of-concepts, and R & D programs are encouraged as well.

Test Practices, Standards, and Facilities: Industry-consensus best practices and standards for the test and evaluation of liquid engines, components and propulsion/vehicle interaction. Status, capabilities, and operation of government and commercial rocket engine test facilities. This includes training, problem reporting, failure investigation, lessons learned, safety, FOD control, process control, and infrastructure improvements to meet aggressive technical goals. Concepts and innovations for engine life testing, engine fault detection, flight qualification testing practices, data reduction and uncertainty analysis methodologies, and other test needs to meet future demands are of interest.

Mission Area II: Liquid Combustion Subsystems and Components

Thrust Chamber Assembly (TCA) Design and Applications: This mission area addresses the components and subcomponent features required in all sizes of liquid rocket engines. Components include main combustion chambers, preburners, gas generators, nozzles, high temperature nozzles, and their subcomponent features including items such as injectors, stability aids, and coolant passages. Papers on combustion devices are being sought that cover all aspects of design analysis, component test results, test rig development, diagnostic techniques, and novel design features that are being made possible by manufacturing advances.

Hydrocarbon Fuel Properties, Performance, and Specifications and Processes: Papers addressing chemical composition, physical properties, fit-for-purpose quality, cooling and combustion performance, and specification for various hydrocarbon fuels, including RP-1/RP-2, methane, LNG, JP-10 and other high energy density propellants, and alternatively derived fuels (F-T, fIPK, ATJ, etc.); experimental and numerical efforts to characterize operational performance of these fuels in terms of cooling, combustion, and other application-specific processes.

Combustion Stability: Papers addressing design and performance challenges, modeling and simulation techniques, and scaling methods associated with combustion stability in main combustion chambers, preburners, and gas generators for all sizes of liquid rocket engines.

Liquid Injection Systems: The injection system of liquid rocket engines is critical to system performance. This mission area seeks papers describing new injector concepts, the physical processes required to understand injection concepts (including supercritical jets, sprays, and droplets), and methods to determine injector performance and stability.

Modeling and Simulation: Recent advances in modeling and simulation bring forward new capabilities to performance prediction and design of combustion devices. Papers are sought that look at the recent developments, new techniques, results of implementation or comparison with tests. Aspects covered include, but are not limited to: integrated models, injector element dynamics, hot gas flow fields, heat transfer, cooling mechanism, modeling of conventional and novel additively manufactured design features relative to coolant passages, hot wall features, injectors, etc.

Advanced Liquid and Gel Propellants: Papers are sought addressing advanced liquid and gel propellants and the development of supporting technologies such as "green" propellants, fuel management systems and lightweight tankage systems to advance state-of-the-art chemical capabilities.

Hybrid Rocket Engines: Papers addressing hybrid rocket engine systems and the combustion process in these systems.

Mission Area III: Liquid Propellant Feed and Pressurization Systems

Turbomachinery Design and Applications: Turbopump-fed liquid rocket engine systems require the use of high speed and high-performance rotating machinery. Turbomachinery for this application requires support from a wide range of technical disciplines. Technical areas typically considered include the design, analysis, and testing of inducers, impellers, turbines, seals, bearings and structural elements. Papers on liquid rocket engine turbomachinery are being sought that cover all aspects of design, analysis, code development, component test results, test rig development, diagnostics techniques, and system level testing.

Pressurization and Feed Subsystem Design and Applications: This area covers all aspects of design, analysis and testing of the propellant feed system and engine system specific elements. The propellant feed system is composed of tanks, major component lines, pressurization systems, ducts, feed system control valves, and suppression systems. Engine system specific elements include ducts, flow measurement devices and valves. Papers are being sought which address design, analysis, tool development, diagnostics techniques, and testing of propellant feed system elements and engine system specific elements.

Electric Pump Systems: Advances in battery technology and electric motor technology have made it possible to use electric motors to drive propellant pumps. Electric pump systems have applications in rocket engines and propellant feed systems. Papers on electric pump systems are being sought that describe the unique flight system requirements, architecture, and design constraints. Also encompassing all aspects of the pump design, analysis, control system design, component test results, test rig development, diagnostics techniques, and system level testing.

Mission Area IV: Advanced Materials for Liquid Propulsion Applications

Material Applications in Liquid Rocket Engines: Papers are sought addressing advanced materials and processing for liquid rocket propulsion systems, including the following Eight areas:

1. Material technologies resulting in significant thrust-to-weight ratio increases and/or performance advantages over state-of-the-art capabilities
   - Lightweight, high-temperature nozzle materials
   - Polymer matrix composites (PMCs) for lightweight components and structures
   - PMC resin development for high-temperature or cryogenic environments
   - Materials for lightweight lines, ducts, valves, and tanks
   - Metals, ceramics, and composites for component applications
   - Materials and production methods for lower lifecycle costs
   - Near net shape production for components and structures
   - Modeling of materials for liquid rocket engines
2. **Materials for Commercial Space Transportation:** The recent shift by NASA to commercial space transportation to the ISS under COTS has created the need for low-cost, high performance material solutions for a new generation of space vehicle engines. Papers are sought addressing areas such as:
   - Materials selection criteria
   - Material characterization requirements
   - Flight qualification standards for materials
   - Risk management related to materials selection
3. **Heavy Lift Launch Vehicles:** A need for heavy lift launch vehicles has been identified for future space exploration and other missions. Such a launch vehicle will likely require engines in the 1 million pound thrust class as well as smaller upper stage and other liquid-fueled engines. Papers are sought addressing materials and processes for:
   - Manufacturing and production of new liquid fueled engines
   - Integrated health management for materials and structures
   - Lightweight tanks and composite ducts
   - Materials for reusable engines
   - Concepts for material solutions that optimize the entire propulsion system for improved performance
4. **Nanotechnology for Liquid Propulsion Systems:** Application of new nanomaterials to liquid propulsion systems. Papers are sought to address:
   - Nanomaterials and nano processing to improve strength, conductivity, density, modulus, and other properties
   - Concepts of how to integrate nanotechnology into future liquid-fueled rocket engines
   - Nanotechnology areas that may have high payoffs for liquid rocket engine systems
5. **Materials for Green Fuel Engines:** new engines with "green" fuels such as methane and ethanol as well as newer fuels that go beyond the traditional definition of green fuels have been proposed. Methods to address the compatibility of these fuels and their combustion products with current and potential future engine materials. Papers are sought to address:
   - Environmental corrosion issues for both the fuels and the combustion products
   - Compatibility test methods
   - Materials concepts for future green fueled engines
   - Concepts for future engines and materials for them
6. **Turbomachinery Materials:** Turbomachinery require new materials or coatings to address new engine cycles such as oxygen-rich staged combustion. Materials to address chemical and temperature environments considerably different than prior expander or gas-generator cycles. Papers are sought to address potential issues such as:
   - Hydrogen and oxygen compatibility
   - Testing for oxygen promoted combustion and hydrogen embrittlement
   - Development processes for new materials
   - Criteria for inserting new materials into turbomachinery for hydrogen-, hydrocarbon- and green-fueled engines
7. **Additive Manufacturing:** Processing methods using additive manufacturing techniques and other three-dimensional rapid prototyping methods that offer potential for reduction of times to produce parts, cost savings and increased part complexity such as:
   - selective laser sintering,
   - electron beam sintering,
   - UV additive manufacturing,
   - microwave additive manufacturing.
8. Papers are sought for additive manufacturing technologies applied to liquid propulsion applications:
   - Development of techniques
   - Practical examples of application
   - Approaches for Acceptance and Certification for Use

Mission Area V: Rotating Detonation Rocket Engines

RDRE Thrust Chamber Assembly (TCA) Design and Applications: This mission area addresses the components and subcomponent features required in all sizes of RDREs. RDRE components include main combustion chambers, preburners, gas generators, nozzles, high temperature nozzles, and their subcomponent features including items such as injectors, and coolant passages. Papers are sought on rotating detonation combustion devices including:

- Unsteady RDRE combustor/nozzle design analysis and simulations for gaseous and multiphase rocket propellants
- Compatible materials for the unique unsteady supersonic environment
- Component test results
- Test rig development
- Diagnostic techniques & sensors
- State of the art RDRE modeling simulation techniques for analysis/design of these systems

- Reduced order modeling approaches for optimizing RDRE performance and design

RDRE Test Practices, Standards, and Facilities: Industry-consensus best practices and standards for the test and evaluation of rotating detonation rocket engines, components and propulsion/vehicle interfaces. Papers are sought on state of the art in RDRE testing, including:

- Status, capabilities, and operation of government and commercial RDRE test facilities
- Innovative concepts for RDRE testing, data reduction, and model validation
- RDRE testing uncertainty analysis methodologies

Mission Area VI: Propulsion-Induced Environments and Structural & Thermal Loads

This area focuses on propulsion-induced environments and the associated loading of a physical structure or material within the surroundings. Fundamentally, an environment represents a source of loading. The source may be a pressure, thermal, thrust, acceleration, or other type of loading. The physical structure may be a launch vehicle, spacecraft, lander, payload, crew, surrounding structure, ground, or other object or material; these are loosely grouped in the summary below as "launch vehicle and surroundings". While many environments occur during the liftoff phase or landing phase, propulsion-induced environments during the entire mission should not be excluded from this area. The subject area is split into two focus areas, Propulsion-Induced Environments and Structural & Thermal Loads, however this does not exclude many examples where two-way coupling occurs between the source and the structure.

Propulsion-Induced Environments: Modeling, Analysis, Testing, Design, and Validation. Launch vehicles and surroundings are subjected to environments that are induced by propulsion systems. This focus area encompasses the environment and includes analytical and computational tools, models, forcing function definitions, testing, methodologies, validation, physical processes, and mitigation approaches that support propulsion-induced environments.

Examples of propulsion-induced environments are not limited to this list: Liftoff/Landing Acoustics, Engine and Booster Ignition Overpressure, Liftoff Debris Transport, Excess Hydrogen Pop, Thrust Oscillations, Hold-down Acoustics, Engine Nozzle Flow Transient Acoustics, Booster Igniter Shock and Throat Plug Expulsion Overpressure, Infrasonic Acoustics, Far-field Acoustics, Plume Impingement, Plume-Induced Thermal environments, Emissions, Propulsion Noise Sources, Propulsion Blast, and Plume-Surface Interaction.

In general, most of the environments listed above produce a direct pressure, thermal, or acceleration loading and are relatively unambiguous in the environment it produces. Several examples though are not as evident and are described here. Plume-Surface Interaction is an interaction between the environment and the structure but is listed in Propulsion-Induced Environments rather than Structural and Thermal Loads for simplicity. In Plume-Surface Interaction, the plume imparts a pressure, thermal loading, or other environment onto a physical structure or material such as concrete or soil. Physical processes associated with plume-surface interaction could result in pyrolysis and melting, ablation and erosion, and fracture and spalling of material, soil, or regolith. Debris transport and soil particulate impingement to vehicle and surroundings at liftoff and landing can contribute to detrimental loading in the form of impact energy. Emissions or dust can be hazardous to the personnel or to the environment. There are also examples of two-way coupled phenomena such as Slosh and Pogo. In the context of a propulsion-induced environment, a thrust imbalance may contribute to slosh, however the fluid would subsequently impart a pressure on the tank wall relevant to tank design or contribute to a change in mass distribution relevant to vehicle control. And while Pogo is generally recognized as an instability, there are technical aspects and physical processes that fall within this area regarding coupled fluid-structural interaction induced by the propulsion system. Finally, as an example environment mitigation approach, design and analysis activities of the ground system are captured in this area – such as water suppression systems, hydrogen burn-off systems, and appropriate aspects of launchpad design.

Structural and Thermal Loads: Modeling, Analysis, Testing, Design, and Validation. Launch vehicles and surroundings are subjected to environments that are induced by propulsion systems. This focus area encompasses the structural and thermal response to these environments and includes analytical and computational tools, models, testing, methodologies, validation, physical processes, and mitigation approaches that support structural and thermal loads.

Propulsion-induced environments such as dynamic pressure loading is a principal source of structural vibration which may result in the malfunction and fatigue of launch vehicle and surroundings. Pressure loading from the propulsion-induced environments on the external surfaces of a vehicle can damage the vehicle, give rise to sound pressure levels inside a payload cabin which can damage payloads, or inside a crew cabin which may impact the crew's health, safety, or ability to communicate. Other propulsion-induced environments also contribute to stress and failure of vehicle hardware and surroundings.

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SPACECRAFT PROPULSION (SPS)

The 13th SPS seeks abstracts on the full array of spacecraft propulsion technology interests including chemical propulsion, electric propulsion, micropropulsion, nuclear thermal propulsion, propellant management, aerocapture, solar sails, solar thermal propulsion, tether systems, in-space propulsion infrastructure, and technologies for the future. Possible applications to these technologies are orbit to orbit transfer, attitude control, non-terrestrial ascent/descent, station keeping, deep space, formation flying, drag makeup, and orbital rephasing. Please direct questions about the SPS mission areas to the JHU WSE ERG Technical Representative for SPS.

Mission Area I: Chemical Propulsion

Papers are invited that cover all areas of chemical propulsion including monopropellant, bipropellant, gel, solid, and hybrid chemical propulsion systems. Some current areas of interest include, but are not limited to, advanced propellant formulations and propulsion system developments for modern spacecraft and new missions.

Decreased toxicity monopropellant thruster technology development has been of primary interest for spacecraft applications in the last decade. Monopropellant technology is of critical importance to spacecraft operations and principally relies upon catalyst technology.

New propulsion system architecture approaches and technology demonstrations that are being pursued to reduce cost, expand capabilities, and enable new missions are also of significant interest. Also, reuse or modification of existing propulsion systems and components has been an ongoing and emerging area of development where publications are sought. This includes the reuse of heritage components and developments in reusable vehicles, systems, or components.

Increasing community knowledge of lessons learned and the relative impact of forthcoming technologies and approaches will support the transition and evolution of these propulsion approaches. Papers are solicited on the following topics of particular interest for sessions supporting spacecraft chemical propulsion:

Propellant Factors -

- Propellant physical property characterization
- Formulation, pre-cursor considerations, synthesis, and quality control measures
- Propellant advantages, disadvantages and their impact to operations (ground and flight)
- Propellant (decreased toxicity and state of the art) storage and management
- Decomposition, kinetics, and combustion environment impact to materials and duty cycle
- Impact of propellant impurities on performance including catalytic life

Thruster / Engine / Component Factors -

- Impact of propellant impurities on delivered performance including catalytic and non-catalytic reactor performance and life
- Injection technologies and concerns such as propellant atomization or dispersion, including impacts of non-volatile residue accumulation factors and irregular feed
- Decomposition and ignition means for all areas of chemical propulsion including:
  - Development and performance of alternative catalysts, substrate, and active materials with respect to response and life limiting factors
  - Augmented catalytic and non-catalytic decomposition for monopropellants
- Developments and issues in the reuse, modernization, and/or requalification of components
- Integrated performance and operations including:
  - Duty and thermal cycle impacts to response, repeatability, and useful life
  - Relationship of propellant conditions, component design, and ignition factors
  - Relationship of propulsion system conditioning requirements by mission
  - Effectiveness in modeling variation of performance for system design and mission planning

System / Mission Factors -

- Throttleable and pulsed system delivered performance including combustion stability effects
- Propulsion system architecture considerations, configuration trades, and mission optimization
- Propulsion system operations, diagnostics, and failure management
- Operational condition concerns such as conditioning of propellants and testing of environments
- Status, infusion viability, and impact of new propulsion technology and pathfinder activities

Mission Area II: Electric Propulsion

Papers are invited in all areas of electric propulsion (including solar- and nuclear -powered systems). Topics of interest include:

- **Basic Research and Development of Electric Propulsion Thrusters:** This area includes physics of electric propulsion processes, thruster technology development, advanced and breakthrough concepts, high-power electric propulsion, hybrid and dual-mode systems using electric propulsion, alternate propellant research, laboratory plasma diagnostic techniques, and electric propulsion ground test facilities effects.
- **Systems Engineering of Electric Propulsion Subsystems:** This includes electric propulsion subsystem design, propellant storage and feed systems development, power processing units design and testing, and integrated system testing of electric propulsion subsystems.

- **Electric Propulsion Flight Programs and Mission Studies:** This includes reporting on: flight electric propulsion hardware development; ground and flight system operations; space qualification programs; flight plasma diagnostics development and experiments; in-flight programs status; electric propulsion mission studies for commercial, science, and human exploration space missions.
- **Electric Propulsion Modeling and Simulation:** This includes computational models for physical behavior, innovative numerical methods, development of robust computational validation techniques and exploitation of novel hardware configurations. This includes models and simulations supporting: electromagnetic and electrostatic thruster development; interrogation of ground facilities effects; prediction of plume signatures and spacecraft/plume interaction behavior.

Mission Area III: Cube / Nano Satellite Propulsion

Papers are invited to discuss micro-propulsion for CubeSATS, NanoSATS, and other small satellites. Applications, concepts, and designs for propulsion systems or components for small satellites are of interest. Of particular interest are papers on components such as valves, tankage, propellant feed system elements, and power conditioning for micro-propulsion applications. Other areas of interest include:

- Micro-propulsion
- Nano-propulsion
- Micro-thrust devices
- Cube satellite applications
- Micro satellite applications
- Nano-satellite applications
- Cube/Micro/Nano satellite propulsion systems
- Small component development and design for small propulsion applications
- Power conditioning for micro-EP applications
- System-level integration studies
- Mission design studies
- Flight demonstrations

There will be a panel discussion focused on micropropulsion design reference missions and their propulsion system requirements for flight qualification and TRL validation. Several design reference missions and their micropropulsion system requirements will be discussed that capture subsets of mission applications. Papers are invited on micropropulsion mission applications with well-developed and defined propulsion system requirements including performance, mass, volume, propellant throughput and lifetime to focus micropropulsion development and qualification programs and anchor TRL validation in relevant application requirements.

Mission Area IV: Future Technologies

Papers are invited for a range of advanced future space propulsion technologies, including but not limited to the following listed areas.

Nuclear Thermal Rocket (NTR) propulsion design, testing, and utilization for future human exploration missions of the solar system, including:

- NTR spacecraft and mission design for human Mars Exploration mission
- Solid core NTR concepts with or without bimodal capability
- Common reactor design for both propulsion and surface power generation
- Candidate nuclear fuel options
- Reactor controls and shielding
- NTR test methods and facilities
- NTR demonstration options
- Safety, reliability, risk analysis and crew-rating
- NTR vehicle operations and costs
- Planned and/or funded missions
- Near-term mission concepts
- Innovative system or subsystem designs

Advanced concepts for both near- and far-term future space propulsion focusing on technologies that promise significant gains in specific impulse, and/or power density, but are based on known fundamental physics, such as:

- Fusion energy in space propulsion including conventional magnetic schemes, inertial fusion schemes, inertial electrostatic confinement, magnetically insulated inertial fusion, fission-fusion hybrid systems, and concepts that utilize fusion reaction directly or indirectly.
- Laser or microwave propulsion
- Solar sail propulsion, electrodynamic and momentum exchange tether propulsion, and other innovative technologies that use the natural environments of space to derive propulsion without the expenditure of conventional fuel.

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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 1 December 2023**.

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.

Requirements for JANNAF workshops and established best practices can be found in the **JANNAF Workshop Guide for Chairs**; this document will guide you through the planning and approval process for workshops held at a JANNAF meeting.

To request a workshop you must submit a **Workshop Request Form** to your JHU WSE ERG Technical Representative (see pages 6 - 15 for contact information) or the JANNAF Meeting Planning Team at **meetings@erg.jhu.edu**. This form must be submitted to ERG by **Friday, 1 December 2023**. The agenda and invitation list is due **Friday, 9 February 2024** for inclusion in the Preliminary Program, and must be approved no later than **Friday, 8 March 2024** 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 1 December 2023., 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, 9 February 2024**. 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, 8 March 2024.** 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**.

JANNAF AWARDS PROGRAM

In the tradition of recognizing the outstanding achievements by members of the propulsion community, the JANNAF Technical Executive Committee (TEC) and Programmatic and Industrial Base Committee (PEC), as well as the Modeling and Simulation (MSS), Liquid Propulsion (LPS) and Spacecraft Propulsion (SPS) subcommittees, are soliciting nominations for awards to be presented at the meeting. A TEC or PEC Award is justified if the achievement or service is in a technical or programmatic area that is not covered by an existing subcommittee, or is of such scope or magnitude that merits this recognition.

Special Recognition Awards

The **Special Recognition** awards for **Sustained Contribution** and **Lifetime Achievement** honor individual achievements, either in the last 18 months or for a lifetime of dedicated service. These awards are the most prestigious subcommittee awards and reflect on the awardees' contributions to JANNAF.

Special recognition award winners will be selected by respective subcommittee Awards Committees based on review of the nomination in consideration of the following:

- Technical value of the achievement(s) including level of technical complexity and challenge, quality of results, degree of innovation and timeliness of research.
- Impact of the achievement on the broader propulsion community.
- For individuals nominated for lifetime achievement, demonstrated participation in technical societies as evidenced by positions held and papers published will be considered favorably.

Outstanding Achievement Award

The **Outstanding Achievement Award** is given for the most outstanding technical achievement in the subcommittee's area by an individual, by a team within an organization, or by a team of organizations. To recognize the varied nature of the JANNAF subcommittees and the accomplishments of their communities, nominations may be solicited and given in the two focus areas of R&D Technology and Operational Systems.

- The achievement shall have been accomplished in the previous 18 months.
- The nominees must have worked for the organization during the same 18-month period of performance.

Certificate of Commendation

The **Certificate of Commendation** is given to recognize an individual whose contributions within the last 18 months have been pivotal in ensuring the success of a JANNAF activity.

Certificate of Appreciation

The **Certificate of Appreciation** is given to recognize individuals for outstanding contributions and dedicated service to JANNAF.

Nominations

To nominate an individual for one of the above awards please use the **JANNAF TEC/PEC and Subcommittee Award Nomination Form**. Nomination submissions should include the following:

- A description of the achievement or distinguished service, of no less than 200 and no more than 1000 words. The description must be typed or provided in electronic format (Adobe Acrobat PDF or MS Word) via email.
- Supporting data (if desired) of no more than 10 pages.
- Supporting curriculum vitae, list of publications, and/or professional activities as required to support the nomination.
- Contact information for the nominee(s) and the nominator, including organization affiliation, phone number, and email address.

Nominations should be submitted to the appropriate JHU WSE ERG technical representative no later than **Friday, 1 March 2024.**

Best Paper Awards

In addition to the nomination awards listed above, JANNAF recognizes authors of papers that exhibit excellence and significant merit with the **Best Paper Awards**. Best Paper Awards from this meeting will be acknowledged in *JANNAF News* and announced at the next JANNAF Subcommittee meeting.

Best Student Paper Awards

The **Best Student Paper Award** will be given to a current undergraduate or graduate student who authors a paper that exhibits excellence and significant merit. One paper will be selected to receive the Best Student Paper Award. Please be sure to indicate within the abstract submission if you wish to be considered for the Best Student Paper Award. Please note that a student must be the paper's primary author to be considered for this award.

As a reminder: student authors must conform to the same JANNAF attendance eligibility requirements as other authors, per the policy on non-government attendees at JANNAF meetings given on page 2. Student authors are encouraged to work with their advisors to ensure they meet these requirements, and should contact the JANNAF Security Team (Mary Gannaway at **mgannaway@erg.jhu.edu** or Mionna Sharp at **msharp@erg.jhu.edu**) at their earliest convenience with questions regarding their eligibility and participation.

Student papers will be reviewed upon submission of their cleared manuscripts. In order to be considered for the student best paper selection, the completed paper must be provided to JHU WSE ERG by **Friday, 1 March 2024**. A signed and completed JANNAF Publication Clearance Form must be submitted for the paper as well. The Best Student Paper Award will be presented at the JANNAF meeting at which the paper is given.

UPCOMING JANNAF MEETINGS

52nd Combustion
40th Airbreathing Propulsion
40th Exhaust Plume and Signatures
34th Energetic Systems Hazards
Joint Subcommittee Meeting
Programmatic and Industrial
Base Meeting

4 - 8 December 2023
Salt Lake City, UT
Visit December 2023 meeting website

71st JANNAF Propulsion Meeting
Programmatic and Industrial
Base Meeting
18th Modeling and Simulation
14th Liquid Propulsion
13th Spacecraft Propulsion
Joint Subcommittee Meeting

6 - 10 May 2024
Oklahoma City, Oklahoma
Visit May 2024 meeting website

49th Structures and Mechanical Behavior
45th Propellant and Explosives
Development and Characterization
34th Safety and Environmental Protection
2nd High Temperature Material
Applications
Joint Subcommittee Meeting
Programmatic and Industrial
Base Meeting

9 - 13 December 2024
Location TBA

ABSTRACT DEADLINE

Friday, 1 December 2023