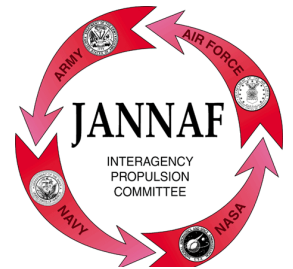


# **JANNAF** INTERAGENCY PROPULSION COMMITTEE

## JOINT ARMY-NAVY-NASA-AIR FORCE

63rd JANNAF Propulsion Meeting  
Programmatic and Industrial Base Meeting  
47th Combustion (CS)  
35th Airbreathing Propulsion (APS)  
35th Exhaust Plume and Signatures (EPSS)  
29th Propulsion Systems Hazards (PSHS)  
JOINT SUBCOMMITTEE MEETING  
**16 - 20 May 2016**



## **Announcement and Call For Papers**

**Abstract Deadline**  
**7 December 2015**

**Newport News, Virginia**

last updated 1/27/16



The May 2016 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) will consist of the 63rd JANNAF Propulsion meeting; the Programmatic and Industrial Base (PIB) meeting; and the Joint Meeting of the 47th Combustion / 35th Airbreathing Propulsion / 35th Exhaust Plume and Signatures / 29th Propulsion Systems Hazards Subcommittees. Dr. Christine M. Michienzie with OSD (AT&L), MIBP, Alexandria, Virginia, is the meeting chair. This meeting will be held **Monday through Friday, 16 - 20 May 2016**, at the **Newport News Marriott at City Center in Newport News, Virginia**. Please refer to page 4 for hotel and area information.

## ATTENDANCE REQUIREMENTS

The overall security level of the meeting is **Secret**. Unclassified sessions will be held at the Newport News Marriott at City Center in Newport News, VA; classified sessions will be held at NASA Langley Research Center, located in Hampton, Virginia, approximately a fifteen minute drive from the hotel. Attendance, applicable to presenters as well, is restricted to qualified U.S. citizens. *No foreign nationals will be 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 [www.dlis.dla.mil/jcp/](http://www.dlis.dla.mil/jcp/).

**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:** To register, you must have a JANNAF Secure Portal account. Please visit the [Registration](#) page of the meeting website for additional information and important links. *All presenters do need to register and pay the registration fee.*

Questions concerning attendance eligibility should be directed to the JHU-CADRE Facility Security Officer, Mary Gannaway, at (410) 992-7304, ext. 211.

## PURPOSE

The purpose of the JANNAF Interagency Propulsion Committee is to coordinate fundamental research, exploratory development, and advanced development programs; standardize procedures and nomenclature; promote and facilitate the exchange of technical information; and accomplish problem solving in areas of joint agency interest on propulsion systems used in missiles, rockets, boosters, spaceplane, spacecraft, satellites, and guns. JANNAF subcommittees focus their resources on technical issues of interest to the JANNAF agencies.

## SCOPE

### 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 63rd JPM in 2016 spans eight mission areas: Tactical Propulsion; Missile Defense/Strategic Propulsion; Propulsion Systems for Space Access; Gun and Gun-Launched Propulsion; Propulsion and Energetics Test Facilities; Sensors for Propulsion Measurement Applications; System-wide Application of Additive Manufacturing for Propulsion Applications; and Improvised / Homemade Explosives.

In conjunction with the JPM, the standing JANNAF subcommittees for Combustion, Airbreathing Propulsion, Exhaust Plume and Signatures, and Propulsion Systems Hazards will also hold their biennial meeting (held every 18 months). To learn more about the scope of the standing JANNAF subcommittee meetings, please visit the meeting website at <https://www.jannaf.org/mtgs/May2016/pages/index.html>.

### Programmatic and Industrial Base

The JANNAF Programmatic and Industrial Base (PIB) Committee was created with the approval of the [updated JANNAF Charter](#) by the Department of Defense and the National Aeronautics and Space Administration in 2014. As stated in the [Charter](#), the "Programmatic and industrial base areas of interest include integrated program plans and key decision points; industrial base assessments; risks and opportunities with respect to skills, knowledge, and

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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

The Combustion Subcommittee (CS) covers analytical modeling and experimental research on chemical combustion phenomena for solid, liquid, hybrid, and airbreathing missile, space, underwater, and gun propulsion systems.

### Airbreathing Propulsion Subcommittee

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

### Exhaust Plume and Signatures Subcommittee

The Exhaust Plume and Signatures Subcommittee (EPSS) addresses the phenomena associated with the exhaust from rockets, ramjets, space, gun propulsion systems, and Electro-Optical/Infrared (EO/IR) signature community.

### Propulsion Systems Hazards Subcommittee

The Propulsion Systems Hazards Subcommittee (PSHS) examines potential hazards associated with missile, space, and gun propulsion systems.

## ABSTRACT SUBMITTAL INSTRUCTIONS

- The technical areas to be addressed are defined in this announcement. Individuals who wish to submit an abstract should carefully review the areas and complete and submit the electronic [Abstract Submittal Form](#) posted on the [May meeting website](#).
- The submission of an abstract represents an agreement to **submit a final paper for publication by 18 April 2016**, attend the meeting, and deliver a 30-minute presentation. Your presentation will be heard by all qualified individuals within industry, government, and university organizations. If your paper cannot be presented to all qualified attendees, it cannot be presented in this program without specific approval from members of the JANNAF Executive Committee.
- Submit only unclassified abstracts. Abstracts will not be published and will only be used by the program committee members for paper selection purposes.
- Limit the abstract to 250-300 words and exclude tables and 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.

- Please submit using the [Abstract Submittal Form](#), which can be downloaded from the [May meeting website](#).
- Obtain management approval on the abstract form to ensure availability of resources for your participation in the meeting and confirm that the presenting author is a qualified U.S citizen.
- **Many organizations require abstracts to be processed through an approval system prior to submission.** This process takes additional time, so authors should **plan accordingly and begin the process early in an effort to meet the abstract deadline date.**
- Remember, ***you 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 completed Abstract Submittal Forms to CADRE is **7 December 2015.**

CADRE accepts only **electronic submission** of abstracts and papers. **Abstracts must be submitted on the [Abstract Submittal Form](#):**

- Via email to: [scohen@cadre.jhu.edu](mailto:scohen@cadre.jhu.edu); (*Distribution A only*); **OR**
- Uploaded to CADRE’s secure server as follows:
  1. Go to <https://webdatabase.cpia.jhu.edu/docorg/program/cgi-bin/Login.pl>
  2. Choose Infobase: JANNAF Mtg Abstract Uploads
  3. Type in User Name: Abstract
  4. Type in Password [contact CADRE (410) 992-7302 or 7300 for current password].
  5. Click the “Login” button.
  7. Click on “May 2016 JANNAF Meeting”; choose “Add Document” (to the left of the page)
  8. Complete the “Add Document” form, being sure to Title your Document, select “Upload from Client”, click the “Browse” button and navigate to where you have saved your completed Abstract Submittal Form on your computer. Select the file and click “Open”. Choose the appropriate file format (MS Word or PDF) under Document Type, and click on “Apply”.
  9. Email [scohen@cadre.jhu.edu](mailto:scohen@cadre.jhu.edu) to notify that the file has been successfully uploaded.

**Remember, the deadline to submit completed [Abstract Submittal Forms](#) is **7 December 2015.****

## AUTHOR TIMELINE

Date	Weeks before Meeting	Action
7 Dec 2015	23	Deadline for receipt of <a href="#">Abstract Submittal Forms</a> .
22 Feb 2016	12	Acceptance/rejection letters sent to authors.
29 Feb 2016	11	Deadline for changes to meeting invitation and preliminary program
2 March 2016	11	Invitation, preliminary program, and registration materials forwarded to propulsion community.
14 March 2016	9	Deadline for award nominations.
4 April 2016	6	Deadline for submission of changes to the final program.
18 April 2016	4	Deadline for receipt of manuscripts and paper clearance forms. <b>Papers not received by this date may be removed from the program.</b>
22 April 2016	3	Deadline for reservations at the Newport News Marriott at City Center.
2 May 2016	2	Deadline for reduced registration fee. Deadline for completion of Registration Questionnaire.
2 May 2016	2	Deadline for receipt of presentations.
16 May 2016	0	JPM/PIB/CS/APS/EPSS/PSHS Joint Subcommittee Meeting

## AWARDS

Nominations for JANNAF Executive Committee, CSS, APS, EPSS and PSHS recognition awards are being solicited. Individuals interested in nominating an award recipient should follow the guidelines and instructions on pages 18-19.

## RECOMMENDATIONS FOR WORKSHOPS OR SPECIALIST SESSIONS

Recommendations for workshops or specialist sessions are solicited at this time. Individuals interested in organizing and chairing a specialist session should contact the CADRE Technical Staff member in their respective subcommittee by **December 7, 2015**. See page 18 for additional information and requirements.

## HOTEL AND AREA INFORMATION

Sleeping rooms have been reserved with the Newport News Marriott at City Center in Newport News, Virginia, where all unclassified sessions will be held. Newport News City Center is a mixed-use development with restaurants, shops and entertainment establishments all within walking distance of the hotel, and just a short 15 minute ride from the Newport News/Williamsburg International Airport. The hotel is also just 15 minutes from NASA-Langley Research Center where classified sessions will be held.

### Hotel

The JANNAF room block is not yet open for reservations. When reservations open in late February, the room rate per night for government attendees with a valid government employee i.d. will be at the GSA FY 2016 per diem rate, currently \$89 plus tax (currently 14%) and a \$1 lodging fee per day, for single or double occupancy. The discounted rate for all other attendees will be \$104 plus tax and lodging fee. More details will be posted on the May meeting website when the Meeting Invitation and Preliminary Program have been posted online, and registration has been opened.

### Transportation

Three airports serve the area: Newport News/Williamsburg International Airport (15 minute drive); Norfolk International Airport (30-60 minute drive, depending on traffic); Richmond International Airport (one hour drive). Ground transportation costs range from approximately \$17 for a taxi from the Newport News/Williamsburg airport to over \$100 for a taxi or shuttle from the Richmond airport. More information can be found on the airports' websites. Rental cars are available at each area airport. If planning to attend classified sessions at NASA Langley Research Center, a rental car will be needed for your transportation to that facility. Carpooling is encouraged.

Amtrak has a station in Newport News, just five miles / 15 minutes from the hotel. A taxi between the train station and the hotel will cost approximately \$16.

## 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	CS	APS	EPSS	PSHS
<b>I</b>	Tactical Propulsion	Ignition and Combustion of Gun Propellants	Conventional Ramjet Propulsion	Exhaust Plume Flow Field Analysis	Thermal Decomposition and Cookoff
<b>II</b>	Missile Defense / Strategic Propulsion	Solid Propellants & Combustion	Scramjet Propulsion	Exhaust Plume Radiation	Impact/Shock-Induced Reactions
<b>III</b>	Propulsion Systems for Space Access	Explosive Performance/ Enhanced Blast	Scramjet Propulsion/ Structures	Exhaust Plume Effects	Insensitive Munitions Technology
<b>IV</b>	Gun and Gun-Launched Propulsion	Airbreathing Combustion	Scramjet Component/Engine Testing	Other Exhaust Plume Related Problems	Gun Propellant Vulnerability
<b>V</b>	Propulsion and Energetics Test Facilities	Combustion Diagnostics	Combined/ Advanced Cycle Propulsion	Signatures and Spectral and In-band Radiometric Imaging of Targets and Scenes (SPIRITS)	Propulsion Systems Safety and Hazard Classification
<b>VI</b>	Sensors for Propulsion Measurement Applications	Liquid, Hybrid, and Novel Propellants Combustion	Small/Expendable Turbopropulsion		Energetic Liquid Hazards
<b>VII</b>	System-wide Application of Additive Manufacturing for Propulsion Applications		Fuel Technology		
<b>VIII</b>	Improvised / Homemade Explosives		Component Modeling Simulation		
<b>IX</b>			Advanced Combustion Control		

## JPM MISSION AREAS

The 63rd JPM sessions will cover systems development within the seven mission areas described below. Additional information concerning these areas or the topics being solicited should be directed to the respective Area Chair.

### Mission Area I: Tactical Propulsion

**Co-Chairs:** Dr. Jeremy R. Rice, AMRDEC/Redstone Arsenal

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Mr. Frank C. Tse, NSWC/Indian Head

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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. 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

**Co-Chairs:** Dr. Carlos A. Lopez, Navy Strategic Systems Programs/Arlington

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Dr. Robert J. Jensen, Sierra Lobo, Incorporated/  
Edwards AFB

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This area includes technology applicable to ballistic missiles, trans-atmospheric operational vehicles, and ground- and sea-based 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. 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 areas of:

- Strategic systems
- Ground-based missile defense
- Sea-based missile defense
- Advanced propellants
- Advanced materials
- Insensitive munitions technologies for large rocket motors
- Energy management approaches
- Dual mode systems (airbreathing/rocket)
- Unconventional propulsion
- Divert propulsion/attitude control propulsion
- Post boost control system propulsion
- Manufacturing technologies and fabrication techniques

### Mission Area III: Propulsion Systems for Space Access

**Chair:** Mr. Bruce R. Askins, NASA-MSFC/Huntsville  
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**Email:** [bruce.askins@nasa.gov](mailto:bruce.askins@nasa.gov)

This area focuses on existing or potential primary and auxiliary government, commercial or foreign propulsion systems for earth-to-orbit vehicles. 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
- Description of vehicle systems analysis models and assumptions
- Details of architecture studies and descriptions of promising vehicle architectures
- Uncertainty evaluation of vehicle systems analysis
- 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
- 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

### Mission Area IV: Gun and Gun-Launched Propulsion

**Chair:** Mr. Lucas R. Lopez, ARDEC/Picatiny Arsenal  
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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 solids and liquids
- Unconventional gun propulsion concepts
- System-level gun propulsion studies (gun tube wear and erosion, blast/flash mitigation, improved system survivability)
- Concepts to enable rocket systems to achieve high operating pressures (gun barrel and motor case)
- Assisted projectiles
- Assisted guided munitions
- Insensitive munitions

### Mission Area V: Propulsion and Energetics Test Facilities

**Co-Chairs:** Mr. Michael D. Owen, NASA-WSTF/Las Cruces  
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Ms. Julie A. Carlile, AFRL/Edwards AFB  
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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

**Co-Chairs:** Dr. Gary W. Hunter, NASA-GRC/Cleveland

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Mr. Robert F. Peterson, Aerojet Rocketdyne / Culpeper

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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

## Mission Area VII: System-wide Application of Additive Manufacturing for Propulsion Applications

**Chair:** To be announced

Telephone:

Email:

This area focuses on the use of additive manufacturing as an enabling technology from both an organizational and a systems perspective. Additive manufacturing is critical for reducing manufacturing time and cost to produce specific components for propulsion systems, and multiple JANNAF Subcommittees are addressing the specific application challenges within their areas. Affordability is a critical element for both government and commercial systems. New and innovative manufacturing techniques are working their way into mainstream manufacturing. Before additive manufacturing is widely accepted for general use, it is necessary to understand the technology well enough to proceed with a high level of confidence. This Mission Area emphasizes how the various JANNAF organizations are planning to address the challenges of integrating AM into



propulsion systems. What are the synergies between the JANNAF organizations' AM plans and the AM centers of excellence such as America Makes (as well as others)? How are the JANNAF organizations addressing the integration of AM hardware into existing or new systems? Other areas to consider are overall cost considerations and ROI when incorporating AM hardware into new systems.

Papers should address AM technology roadmaps (government, industry, AM centers), AM integration challenges, strategies for incorporating AM hardware into new or existing systems, and economic considerations.

Additive Manufacturing Technology:

- Government AM Technology Roads Maps/Plans
- AM Centers of Excellence Technology Road Maps/Plans
- Industry AM Technology Road Maps
- What are the ITAR issues facing use of foreign made AM machines?
- Synergy between roadmaps, what is missing?
- Challenges for incorporating AM hardware into systems
- Economic considerations of incorporating AM hardware into new systems
- Are we investing enough into AM?
- Are we investing in the right areas?

## Mission Area VIII: Improvised / Homemade Explosives

**Co-Chairs:** Dr. Kirk E. Yeager, FBI / Quantico

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Mr. William A. Bagley, JHU-WSE / Columbia

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Members of the Improvised Explosive / Homemade Explosives (IE/HME) research community which include The Department of Defense (DoD), Department of Justice (DOJ), Department of Homeland Security (DHS), industry partners and academia are encouraged to discuss new findings and ongoing research efforts to better understand current trends, emerging threats and advances in analytical techniques. This mission area focuses on all aspects of IE/HME related to new research and laboratory safety presented by government, industry and academic subject matter experts to counter terrorist efforts and protect researchers, first responders, and the nation from IE/HME threats.

Papers are sought in the areas of new research of IE/HME with an emphasis on the following; laboratory safety, range safety, storage, safe handling, synthesis, testing, detection methods and technologies, and the identification of new threats.

Papers should address:

- Laboratory Safety
- Range Safety
- Storage (in the laboratory and on the range)
- Mixing and Synthesis Methods and Safety
- Challenges to the Academic Community
- Sensitivity of HME
- Lessons Learned

## JHU-WSE CADRE Technical Representative

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## CS MISSION AREAS

The JANNAF 47th 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 solicited that will aid in developing design criteria to build efficient and stable combustion 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

**Co-Chairs:** Dr. Michael J. Nusca, ARL/Aberdeen Proving Ground

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Experimental and modeling studies of ignition, flamespreading, and combustion of solid propellants in guns, mortars and novel gas generators are considered. These studies include the investigation of combustion temperature sensitivity, transient combustion, and gun barrel erosion under 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, novel chemical igniter 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 deterred propellants, improved gun erosion and ballistic efficiencies through propellant formulations 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.

### Mission Area II: Solid Propellants and Combustion

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- *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 kinetic studies); hazard initiation of propellants (including inadvertent ignition and effects of high burn rate); methods of extinguishing propellants and implementing thrust termination. 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/PSHS 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. (Papers in this area will be considered for joint CS/PSHS sessions.)
- *Solid Rocket Propellant Combustion Instability:* Development, laboratory, and analytical advancements. 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; 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; methods for obtaining in situ particle size measurements.

- *Combustion, Prediction, Performance, and Other Topics in Solid Rocket Motor Behavior:* The combustion related motor behavior and the application of analytical models, experimental research, and subscale testing to their solution. 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.
- *Solid Rocket IHPRPT Combustion Technologies:* Advancements in the understanding of state-of-the-art in combustion technology in solid rocket motors, modeling, and analysis techniques, funded by IHPRPT and/or IR&D programs are sought. Advancements in solid propellant combustion are of interest and its impact on selection of case, nozzle, and insulation materials or propellant ingredients. Papers on new or improved methods of thermal, structural, and fluid analysis and improved motor performance prediction and evaluation as related to combustion technology are also solicited.

#### **Workshop**

*Ammonium Perchlorate (AP) Decomposition Research – Past and Present:* a workshop on this topic will feature a review paper by Dr. Jeff Kay (Sandia National Laboratory) on past work on AP decomposition, as well as papers on current research in this area – both in decomposition as well as applications. A discussion will follow to highlight any gaps in this area and/or possible follow-on activities. Papers and/or presentations are being sought for inclusion in this Workshop.

#### **Mission Area III: Explosive Performance/Enhanced Blast**

**Co-Chairs:** Dr. Richard J. Lee, NSWC/Indian Head

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Investigations related to the phenomena associated with detonations are sought. Topics ranging from fundamental studies of the mechanism of detonation and combustion to technology development efforts 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.

The Explosive Performance Mission area will hold a Town Hall function to discuss comments and suggestions concerning current and future directions, new ideas for panels, specialist sessions, possible workshop topics, or any other topics of interest to this community.

#### **Specialist Session**

*Enabling Technologies for Lethality Assessments Using Reactive Materials:* This session will focus on determining lethality from reactive fragments and enhanced blast produced via the use of reactive materials incorporated as a casing or inner liner to a casing. This session will feature those actively involved in developing tools and information to improve lethality assessment from reactive materials. Contributing presentations aside from those invited are welcome. Technical

papers are not required but may be submitted in addition to the presentations. Please indicate your desire to be included in the body of your abstract. The session may be held at the secret level if needed. Please indicate potential level of classification you will require in the body of your abstract.

#### Mission Area IV: Airbreathing Combustion

**Chair:** Dr. Mark R. Gruber, AFRL/WPAFB

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*Airbreathing Combustion:* Theoretical and experimental investigations of subsonic, supersonic, and hypersonic combustion phenomena for airbreathing systems (including small or expendable turbojet engines). 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

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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.

#### Mission Area VI: Liquid, Hybrid and Novel Propellants Combustion

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- *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. Areas of interest include: transient system or process analysis; characterization of the physical and chemical processes involved in combustion (e.g., injection, mixing, atomization and vaporization, chemical kinetics, film cooling, reactive stream separation, chamber wall boundary flow, nozzle flow, and supersonic combustion); performance, heat transfer, and cooling prediction methods for subcomponents, components, and assemblies to include: CFD approaches; stability prediction models, (e.g., new models, critiques and/or evaluations of existing models, experimental verification, propellant characterization); development and application of new instrumentation techniques applicable to spray characterization and measurement of species, temperature, velocity, etc.; subsystem effects on stability (e.g., acoustic cavities, slot liners, nozzles); feedback control, or other adaptive methods of stabilizing liquid engines; stability rating techniques; validity of subscale stability studies.
- *Combustion Dynamics of Monopropellant, Bipropellant, and Hybrid Propulsion Systems:* Theoretical and experimental studies of steady and unsteady combustion phenomena in propulsion systems using liquid monopropellants and bipropellants, liquid oxidizers and solid fuels. Areas of interest include injection, mixing, analytical models of combustion and fuel regression rate, ignition system design, and simulation of combustor flows.
- *Combustion Dynamics of Hydrogen Peroxide (HP):* Theoretical and experimental studies of combustion phenomena in propulsion systems using HP. 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; direct energy conversion including fuel cells, thermionics, and thermoelectrics; containment strategies mitigating decomposition over time using advanced materials; manufacture and chemical enrichment of HP; 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. 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., 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; diagnostic measurements, simulation, and combustion instrumentation for underwater propulsion systems.

### Combustion Subcommittee Chair

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## APS MISSION AREAS

The JANNAF 35th Airbreathing Propulsion Subcommittee sessions will discuss technical problems and issues associated with airbreathing propulsion systems for application 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 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.

## Mission Area I: Conventional Ramjet Propulsion

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- *Ramjets:* Welcome are papers either of experimental or theoretical studies related to solid, liquid, and gaseous (aka Ducted Rocket) fueled ramjet systems or the constituents thereof. By example, topics at the component level include techniques for mixing enhancement, active and passive control, plume signature reduction, instability and fuel studies. Whether at the component, section, or system level the author should emphasize isolated/installed level performance benefits.
- *Mode Transition:* Welcome are 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. Papers should emphasize the technology that assists in this transition.
- *Technologies with a Ramjet Application:* Also welcome are 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 II: Scramjet Propulsion

**Chair:** Dr. Aaron H. Auslender, NASA-LaRC/Hampton  
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- *Fundamental (CS) and Applied Technology:* Fundamental and applied supersonic and hypersonic airbreathing propulsion technology and systems, particularly as related to existing technology development and demonstration programs. Development of scramjet propulsion technologies, whether or not related to a particular program or system, will also be of interest. (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 III: Scramjet Propulsion/Structures

**Chair:** Mr. Brett Hauber, AFRL/WPAFB

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- *Propulsion Structures and Materials:* Structures and materials technologies for enhancing and enabling current and future airbreathing propulsion concepts and systems. Topics of interest include: cooled and uncooled propulsion related structures and materials such as engine and nozzle flowpaths, combustion chambers, rotating components, combustor liners, hot ducts, insulation concepts, injectors and nozzles and attachment and joining techniques. Papers on structures and materials that have recently flown, or are planned for flight, on flight vehicles are encouraged.
- *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. Papers on additive manufacturing applicable to scramjets are also encouraged.
- *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 and 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. Papers are also encouraged on structures and materials for flight vehicles, either those that have flown or are planning to fly.

### Mission Area IV: Scramjet Component/Engine Testing

**Chair:** Dr. Thomas A. Jackson, AFRL/WPAFB

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*Maturation of Fully Integrated, Prototype Propulsion Systems:* Physical experiment and numerical approaches to scramjet engine maturation from component development through flight test experiments of fully integrated, prototype propulsion systems are the focus of this area. Current practice for developing scramjet engines blends physical ground and flight test experiments with numerical simulation, applied first to components, then to partial engine flow-paths, and concluding

with tip-to-tail simulation and/or limited flight experiments on fully integrated engines. Papers are solicited in the following areas of interest: impact of vitiation and other test air contaminants on the development process and the prediction of in-flight performance; performance, operability, and durability assessments from ground and flight experimental data (component and full engine evaluation); instrumentation strategies for both steady and transient performance and operability; instrumentation strategies for validating test and analysis with progressively more complex and integrated flow-paths; evaluation of engine transitions (ignition, acceleration, combustion mode transition, etc.); development of test techniques to enhance ground test capability; facility-to-facility and facility-to-flight variations and their considerations for the engine development process; prioritization of matching ground test parameters to flight conditions; uncertainty assessments of ground and flight test measured and deduced parameters and of numerical analysis (including component and engine performance, operability, and durability). (Papers in this area will be considered for joint APS/CS sessions.)

### Mission Area V: Combined/Advanced Cycle Propulsion

**Co-Chairs:** Dr. Charles J. Trefny, NASA-GRC/Cleveland

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*Fundamental and Applied Technology:* Combined, combination, and advanced cycle airbreathing propulsion technology and systems. Of particular interest are analytical and/or experimental research regarding: 1) integration of multiple propulsive cycles; 2) methods for overcoming practical limitations (e.g. turbine-to-scramjet mode transition); 3) variable gas turbine cycles; 4) exploration of airbreathing propulsive cycles other than the Brayton cycle; and 5) system-level evaluations and payoff assessments. (Papers in this area will be considered for joint APS/CS sessions.)

### Mission Area VI: Small/Expendable Turbopropulsion

**Chair:** Dr. Barry V. Kiel, AFRL/WPAFB

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*Basic Technology and System Applications:* Small and expendable turbopropulsion technology and systems related to missiles, drones, UAVs, and JETEC. (Papers in this area will be considered for joint APS/CS sessions.)

## Mission Area VII: Fuel Technology

**Chair:** Mr. Richard W. Wills, AFRL/WPAFB

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*Fundamental and Applied Technology:* Fuels and propellants R&D for conventional and advanced cycle airbreathing propulsion, as applied to missiles, launch vehicles, and advanced aircraft for global reach applications. Conventional non-expendable turbine-powered aircraft are excluded from this call. (Papers in this area will be considered for joint APS/CS sessions.)

## Mission Area VIII: Component Modeling Simulation

**Co-Chairs:** Dr. Mark A. Hagenmaier, AFRL/WPAFB

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- *Data for Propulsion Simulation Code Validation:* Papers summarizing data for airbreathing propulsion code validation are requested which summarize new data and/or existing collections of data. The validation data may represent fundamental physics, propulsion system component operation, propulsion system unit problems, or system data. The physical phenomena investigated may include shock boundary layer interactions, multi-phase flow, turbulent flow, combustion, electromagnetic flow interactions or thermal protection systems. Fundamental thermodynamic data on physical properties of fluids including ionized gasses to supercritical fluids are also of interest. (Papers in this area will be considered for joint APS/CS sessions.)
- *Methods for Propulsion Component Analysis:* Methods suitable for propulsion system analysis are solicited. These methods may be new methods or evaluations of existing methods. The methods may range from CFD simulation methods to integral cycle codes. Methods for efficient and/or accurate modeling of turbulent flow, combustion systems, ionized flow interactions, or multi-phase flow in the subsonic to hypersonic speed range are desired. Another issue of importance is methods for the integration of component models into a larger system simulation. (Papers in this area will be considered for joint APS/CS sessions.)

## Mission Area IX: Advanced Combustion Control

**Chair:** Ms. Alana Jane Spurling, NAWCWD/China Lake

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*Fundamental and Applied Technology:* Papers are requested to advance active combustion control technology for airbreathing propulsion engines. Combustion control includes issues such as NO<sub>x</sub> control, pattern factor control, blowoff control, combustion dynamics control, and mode transition in combined-cycle, launch-vehicle propulsion systems, and combustion control on flight systems. Three main areas of particular interest are: the need for CFD codes to incorporate time accurate transient solutions to model actively controlling combustion; the need for sensors and actuators that are robust, responsive, inexpensive, and light enough to be used in flight for active combustion control; and the need to catalogue sources of suitably characterized sensors and actuators to actively control combustion in air breathing propulsion applications.

### Airbreathing Propulsion Subcommittee Chair

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## EPSS MISSION AREAS

The 35th JANNAF Exhaust Plume and Signatures Subcommittee meeting will include sessions on the phenomena associated with the exhaust from rockets, ramjets, space, and gun propulsion systems. These phenomena can be divided into three technical areas: plume flowfields, plume radiation, and a broad area incorporating other plume effects.

In addition, the EPSS Signatures panel (formerly the Spectral and In-band Radiometric Imaging of Targets and Scenes (SPIRITS) Users Group) promotes technical interchange among members of the Electro-Optical/Infrared (EO/IR) aircraft signature community from both government and industry.

### Mission Area I: Exhaust Plume Flow Field Analysis

**Chair:** Dr. Kevin D. Kennedy, AMRDEC/Redstone Arsenal

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Papers submitted should be concerned with basic definitions of nozzle and exhaust plume flow fields. Solid and liquid rocket and ramjet plumes will be considered. Plume flow fields at all altitudes are important. 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. High altitude vacuum plume problems include noncontinuum flow, nozzle boundary layer expansion, and condensation.

### Mission Area II: Exhaust Plume Radiation

**Chair:** Mr. Jonathan Mautz, NASIC/WPAFB

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Papers are solicited which describe or highlight the following: recent achievements in the exhaust plume radiation area; plume radiation 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 radiation spectrum from ultraviolet through longwave infrared; propulsion systems of all types in terms of thrust level, propellant used, and application, as well as operating altitude; the effects of atmospheric species reacting with the exhaust species or absorbed and emitted energy from exhaust plumes; and plumes in vacuum.

### Mission Area III: Exhaust Plume Effects

**Chair:** Dr. Forrest E. Lumpkin, NASA-JSC/Houston

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Theoretical and experimental papers concerning the prediction of plume impingement pressures and heating for low altitude and/or high altitude spacecraft vehicle applications are solicited. Papers treating the generation of plume contaminants and the effects of such contamination on vehicle surface are of interest. Also of interest are papers concerned with high altitude base convective heating resulting from multi-engine plume interactions.

### Mission Area IV: Other Exhaust Plume Related Problems

**Chair:** Mr. Thomas A. Smith, AFRL/Edwards AFB

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Other papers dealing with exhaust plume technology not covered by the above areas are invited.

### Mission Area V: Signatures and Spectral and In-band Radiometric Imaging of Targets and Scenes (SPIRITS)

**Chair:** Ms. Robin L. Miller, NAWCWD/Point Mugu

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Papers are solicited for the following topics related to Signatures: EO/IR target signature phenomenology; EO/IR atmospheric transmission/radiation phenomenology and modeling; EO/IR signature target measurements; SPIRITS and other signature codes development and improvement; validation and calibration of SPIRITS and other signature codes target modules; computational fluid dynamic analysis and modeling for exhaust and related flowfields; exhaust plume radiation; applications of SPIRITS and other signature codes data for acquisition programs, signature reduction, and operational warfighting.

**Instructional Tutorial(s) are solicited.** Back by popular demand, these instructional tutorials provide the opportunity for each community member to obtain an advanced technical understanding of the inner mechanics of SPIRITS and other signature codes from experts in the field. Each tutorial should be related to a topic listed in paragraph 1. 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.



## Exhaust Plume and Signatures Subcommittee Chair

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## PSHS MISSION AREAS

The JANNAF 29th Propulsion Systems Hazards Subcommittee meeting will address hazards and related technology areas for strategic missile, tactical missile, gun, and rocket propulsion systems. Papers are invited that (1) address all aspects of vulnerability and survivability, loading and firing hazards of propulsion systems, and weapon systems safety or (2) 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 two groups: (1) hazards evaluation and (2) hazards mitigation technology.

### Mission Area I: Thermal Decomposition and Cookoff

**Chair:** Ms. Aubrey D. Farmer, NAWCWD/China Lake

Telephone: (760) 939-7582

Email: [aubrey.farmer@navy.mil](mailto:aubrey.farmer@navy.mil)

- *Thermal Decomposition, Ignition, and Combustion:* Fundamental experimental and modeling studies of decomposition of ingredients and propellants (including kinetics, mechanisms, microstructure, and thermochemistry); ignition of ingredients and propellants (including ignition mechanisms, ignition transients, and effects of heating rate); combustion of ingredients and propellants (including burn rate, pressure exponent, and temperature sensitivity; understanding of the microstructural combustion zone, chemistry and heat release; burning in cracks, defects, and thermally damaged materials; convective combustion and DDT); characterization of thermally damaged materials; coupled thermal-chemical-mechanical modeling of cookoff. (Papers in this area will be considered for joint PSHS/CS sessions.)

- *Cookoff Hazards Assessment and Mitigation:* Cookoff response of propulsion 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.

### Mission Area II: Impact/Shock-Induced Reactions

**Chair:** Dr. Joel B. Stewart, ARL/Aberdeen Proving Ground

Telephone: (410) 278-6877

Email: [joel.b.stewart2.civ@mail.mil](mailto:joel.b.stewart2.civ@mail.mil)

- *Violent Reaction and Detonation of Rocket Propellants:* Micro-characterization of XDT mechanisms and fundamentals associated with explosive response to impact and shock loadings; increased sensitivity to shock leading to detonation of damaged 1.3 propellants; shotgun testing; characterization of impact damage; detonation phenomena of aluminized (underwater) explosives; modeling approaches.
- *Hot Spot Initiation from Shock and Impact:* Fundamental studies; scaling of fundamental physics to predict full scale events; experimental and theoretical studies of hot spot initiation and growth.
- *Detonation Phenomena:* Modeling and experimental studies of shock-to-detonation transition phenomena; deflagration-to-detonation transition phenomena; delayed detonation phenomena; other detonation phenomena not covered above.
- *Response of Energetic Materials to Low Amplitude/Long Duration Impact/Shock Loading:* Scenarios where this type of stimulus might be important include hard target penetrator warheads, solid propellant fallback/ground impact from launch vehicle failures, gun setback, shear induced reactions, and vulnerability of energetic materials to some kinetic energy penetrators. Also of interest is the development and use of small scale tests to simulate these types of impact/shock loading responses for full scale systems. Papers are also requested on diagnostics and experimental arrangements that support the understanding of reaction induced from low-amplitude, long-duration mechanical loading. These papers should focus on the measurement techniques (instead of the materials being tested) and how they produce data on the subject of interest. Examples of topics include techniques to measure material response (stress-strain vs. strain rates, cracking, etc.), reaction thresholds, and severity of reaction.

### Mission Area III: Insensitive Munitions Technology

**Co-Chairs:** Ms. Jamie M. Fisher, Army AMRDEC/Redstone Arsenal

Telephone: (256) 876-5115

Email: [jamie.m.fisher2.civ@mail.mil](mailto:jamie.m.fisher2.civ@mail.mil)

Mr. Stephen R. Struck, AFRL/Eglin AFB

Telephone: (850) 882-3911

Email: [stephen.struck@us.af.mil](mailto:stephen.struck@us.af.mil)

Technology of interest includes historical documentation of past insensitive munitions issues and their impact on system development; mitigation system design and function; insensitive munitions program and technology status reports; assessment of insensitive munitions response and pass/fail criteria; and relationships between small-scale and full-scale testing relative to insensitive munitions. Papers reporting present progress under SBIR insensitive munitions technology funding are also solicited.

### Mission Area IV: Gun Propellant Vulnerability

**Chair:** Mr. J. Kevin Boyd, ARL/Aberdeen Proving Ground

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Email: [james.k.boyd.civ@mail.mil](mailto:james.k.boyd.civ@mail.mil)

Any aspects related to the response of gun propellants, ammunition, and ammunition compartments to shaped charge jets, other penetrators, and spall; and new LOVA propellant technologies. (Papers in this area will be considered for joint PSHS/CS sessions.)

### Mission Area V: Propulsion Systems Safety and Hazard Classification

**Chair:** Dr. Josephine Covino, DDESB/Alexandria

Telephone: (571) 372-6685

Email: [josephine.covino.civ@mail.mil](mailto:josephine.covino.civ@mail.mil)

- *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) creation and effects of propellant damage on hazard response of large SRMs in impact and other accident scenarios.

- *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.
- *Threat Hazard Assessment:* MIL-STD-2105C allows variations in testing to stimuli more realistic to a given weapon system. These stimuli are defined by a threat hazard assessment of that weapon system. Papers describing threat hazard assessment methods and results are solicited.

### Mission Area VI: Energetic Liquid Hazards

**Chair:** Mr. Adam J. Brand, AFRL/Edwards AFB

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Email: [adam.brand@us.af.mil](mailto:adam.brand@us.af.mil)

- Hazards characterization associated with energetic liquids either as part of bipropellant combinations, monopropellant formulations, or liquid ingredients in solid propellant formulations and their respective propulsion systems.
- Identification and application of meaningful analytical/experimental methods for assessing hazard risk with energetic liquids, and the development and standardization of new test methods for assessing hazards in the different propulsion systems considered.

### Propulsion Systems Hazards Subcommittee Chair

Mr. Kevin P. Ford, NAWCWD/China Lake

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### JHU-WSE CADRE Technical Representative

Andrew Taylor, JHU-WSE CADRE/Columbia

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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 CADRE Technical Staff member in their respective subcommittee by December 7, 2015.**

### 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 CADRE Technical Liaison or Shelley Cohen at [scohen@cadre.jhu.edu](mailto:scohen@cadre.jhu.edu). This form must be submitted to CADRE by **Monday, December 7, 2015**. The agenda and invitation list is due **Monday, February 8, 2016**, and must be approved no later than **Monday, April 4, 2016** 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.

To request a Specialist Session for this JANNAF meeting a [Specialist Session Request Form](#) must be submitted to CADRE. This form requires a statement of justification for the Specialist Session as well as a well thought out agenda. Requests will be reviewed by the designated JANNAF subcommittee TSG chair and CADRE for approval; this approval is necessary for any Specialist Sessions to be included in the final program. A specialist session within a JANNAF joint subcommittee meeting is scheduled as a regular technical session.

**The deadline for submission of a Specialist Session request is December 7, 2015.** If you have any questions about planning a Specialist Session please contact your CADRE Technical Liaison or Shelley Cohen at [scohen@cadre.jhu.edu](mailto:scohen@cadre.jhu.edu).

## JANNAF AWARDS PROGRAM

In the tradition of recognizing the outstanding achievements by members of the propulsion community, the JANNAF Executive Committee and the Combustion, Airbreathing Propulsion, Exhaust Plume and Signatures, and Propulsion Systems Hazards subcommittees are soliciting nominations for awards to be presented at the meeting. An EC Award is justified if the achievement or service is in a technical 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.

The award recipients(s) must be able to attend the meeting to receive the award.

### 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 Executive Committee 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 CADRE technical representative no later than **Monday, March 14, 2016**.

## 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 given at the next JANNAF Subcommittee meeting.

## Best Student Paper Awards

The Best Student Paper Award will be given to undergraduate or graduate students who author papers that exhibit excellence and significant merit. One paper will be selected to receive the Best Student Paper Award. All student-authored works will automatically be included in the initial round of consideration with the submission of an abstract; in order to facilitate identification of student-authored works please ensure to clearly state on your abstract that you wish to be considered for the Best Student Paper Award or contact the appropriate CADRE technical representative.

As a reminder: student authors must conform to the same JANNAF 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 CADRE 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 CADRE by **March 14, 2016**. The Best Student Paper Award will be presented at the JANNAF meeting at which the paper is given.

## UPCOMING JANNAF MEETINGS

**63rd JANNAF Propulsion Meeting /  
Programmatic and Industrial Base Meeting /  
47th Combustion /  
35th Airbreathing Propulsion /  
35th Exhaust Plume and Signatures /  
29th Propulsion Systems Hazards  
Joint Subcommittee Meeting**

*May 16 - 20, 2016  
Newport News, Virginia*

**11th Modeling and Simulation / 9th Liquid Propulsion /  
8th Spacecraft Propulsion  
Joint Subcommittee Meeting /  
Programmatic and Industrial Base Meeting**

*December 5 - 9, 2016  
Location To be Announced*