



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

66th JANNAF Propulsion Meeting
Programmatic and Industrial Base Meeting
49th Combustion (CS)
37th Airbreathing Propulsion (APS)
37th Exhaust Plume and Signatures (EPSS)
31st Propulsion Systems Hazards (PSHS)
JOINT SUBCOMMITTEE MEETING

**3-7
June
2019**

Registration is now open!



**Dayton Convention Center
AFRL at WPAFB
Dayton, Ohio**

Meeting Invitation

Last updated 5/31/2019

JANNAF Meeting Invitation - June 2019

You are invited to attend the June 2019 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) which will consist of the 66th JANNAF Propulsion Meeting, Programmatic and Industrial Base Meeting, and Joint Meeting of the Combustion, Airbreathing Propulsion, Exhaust Plume and Signatures, and Propulsion Systems Hazards Subcommittees. This meeting will be held **Monday through Friday, 3 - 7 June 2019, at the Dayton Convention Center in Dayton, OH and the Air Force Research Laboratory at Wright-Patterson AFB, OH.**



The Program Chair for the meeting is **Dr. David R. Gonzalez**, Naval Surface Warfare Center-IHEODTD, Indian Head, MD. A complete list of Program Committee Members can be found on pages 6-9.

The JANNAF Interagency Propulsion Committee coordinates fundamental research, exploratory development, and advanced development programs; standardizes procedures for nomenclature; promotes and facilitates the exchange of technical information; and accomplishes problem solving in the areas of joint agency interest on propulsion systems for missiles, rockets, boosters, spacecraft, satellites, and guns.

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Meeting Scope

JANNAF subcommittees focus their resources on technical issues of interest to the JANNAF agencies.

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 66th JPM in 2018 spans seven 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; and System-wide Application of Additive Manufacturing for Propulsion Applications.

Programmatic and Industrial Base

The **Programmatic and Industrial Base (PIB)** areas of interest include integrated program plans and key decision points; industrial base assessments; risks and opportunities with respect to skills, knowledge, and experience; identification of commonality, innovative acquisition, and partnership opportunities; integrated assessments to identify rocket propulsion industrial base (RPIB) rationalization opportunities; special actions from senior agency, department, or Executive Office of the President (EOP) leadership; and information provided to decision makers for either situational awareness or policy decisions.

Combustion Subcommittee

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.

Johns Hopkins University Whiting School of Engineering Energetics Research Group (JHU WSE ERG)
provides technical and administrative support to the JANNAF Interagency Propulsion Committee.
JHU WSE ERG - 10630 Little Patuxent Parkway, Suite 202, Columbia, MD 21044-3286
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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.

Hotel Information

Sleeping rooms have been reserved with the **Crowne Plaza Dayton**, located at 33 East 5th Street, Dayton, OH 45402. Complimentary amenities for guests include basic high speed internet access throughout the hotel, self-parking, shuttle transportation between Dayton International Airport and the hotel, and shuttle transportation within a 5 mile radius of the hotel, when available.



The JANNAF room rate per night for all attendees is \$103 (GFY2019 GSA per diem rate) plus state and local tax (at this time, 13.5%), for single or double occupancy.

These discounted rooms will be held for JANNAF attendees until the **deadline of Monday, 13 May** at 11:59 p.m. EDT, or until they sell out, whichever comes first. Each individual is responsible for his/her own reservation. Reservations may be made either on the Web (recommended) or by telephone (see below).

Note that the JANNAF discounted room rate is offered beginning Sunday, 2 June through the night of Thursday, 6 June, until sold out. Based upon availability, the hotel will honor the JANNAF discounted rate for up to three days pre- and post-meeting for those who wish to extend their stay (these additional days cannot be reserved via the online reservation link).

Make Your Hotel Reservation Online

Click on the reservation link on the [Location/Hotel Page](#) of the meeting website to make your reservation. Using this link will give you **direct access to the JANNAF meeting discounted room block.**

For additional reservation assistance (including changes or cancellations), please call 1-800-689-5598. When calling, be sure to provide the group name "JANNAF" to obtain the 2019 June JANNAF Conference discounted rate.

Need to cancel your reservation? Be sure to do so no less than 24 hours prior to arrival to avoid paying a cancellation penalty.

Transportation and Parking

The Dayton International Airport (DAY) is located just 13 miles from the Crowne Plaza Dayton. Four airlines offer nonstop flights to DAY from 15 U.S. cities. For more flight options, the Cincinnati/Northern Kentucky International Airport (CVG) offers nonstop flights via 6 airlines from more than 40 U.S. cities. This airport is located approximately 1 hour and 10 minutes from the Crowne Plaza Dayton. Another airport option is the John Glenn Columbus International Airport (CMH), which is about 1 hour and 15 minutes from the hotel in Dayton. This airport is served by 7 airlines that offer nonstop flights to nearly 40 U.S. cities.

The hotel offers complimentary airport shuttle service to/from the Dayton International Airport. Other transportation options at DAY include taxis, Uber, Lyft, and rental cars. If flying to CVG or CMH, your best option is to rent a car to get to Dayton. Visit the [Location/Hotel page](#) of the June meeting website for airport website links; these websites provide more information about ground transportation options.

Note that if you plan to attend classified sessions at Wright-Patterson AFB, you will need a car to get there. Carpooling with other attendees is encouraged.

For those driving personal vehicles or renting a car, self-parking is complimentary for overnight guests of the Crown Plaza Dayton at the Oregon District Parking Garage, which is connected via skywalk to the hotel. Attendees commuting or staying elsewhere should anticipate a maximum parking charge of \$6.00 per day at the Oregon District Parking Garage, which is also connected to the Dayton Convention Center. A parking map has been provided on the Hotel page of the meeting website.

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Unclassified Meeting Site

Unclassified sessions will be held at the Dayton Convention Center in Dayton, Ohio. For attendance at Unclassified sessions only, please see the Security/Attendance Requirements and Registration instructions below and on page 5.

Classified Meeting Site

Classified sessions will be held at the Air Force Research Laboratory at Wright-Patterson AFB, Ohio. **You must check in at the JANNAF Registration Desk at the Dayton Convention Center to obtain your JANNAF badge prior to attending any classified sessions.**

Please read BOTH the Security/Attendance Requirements and Registration sections carefully.

Security/Attendance Requirements

The overall security classification of this meeting is Secret.

To qualify to attend this meeting, all attendees must be 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. All attendees must also be invited U.S. citizens qualified to receive unclassified, limited-distribution information. **No foreign nationals will be permitted to attend.**

In addition, CLASSIFIED SESSION attendance is restricted to invited U.S. citizens who possess, at minimum, a SECRET U.S. Security Clearance with a need-to-know in the areas of rocket, missile, space, or gun propulsion.

Questions concerning attendance eligibility should be directed to the JHU WSE ERG Facility Security Officer, Mary Gannaway, at (410) 992-7304, ext. 211 or mtg@jhu.edu.

**The deadline to register for
Classified session attendance is
13 May 2019.**

**Follow instructions on this page
applicable to your organization type.**

Registration

To register for any portion of this meeting, you must have a JANNAF Secure Portal account. Please visit the [Registration Page](#) of the meeting website for additional information and important links.

Ⓐ ALL ATTENDEES must do the following:

1. Go to the [Registration Page](#) of the meeting website.
2. Click on the link to "REGISTER for the JUNE meeting."
3. Log into your JANNAF Secure Portal account.
4. Complete the online Registration Form.
Required for all attendees. There is no financial commitment with this step.

If attending CLASSIFIED sessions:

Complete registration step Ⓐ as noted above (1-4). NEXT, complete the following ADDITIONAL step(s) that pertain to your organization type.

DoD Employees: Ⓐ and Ⓑ

DoD Contractors: Ⓐ and Ⓒ

DoE and NASA Employees: Ⓐ and Ⓒ

DoE and NASA Contractors: Ⓐ and Ⓒ

Steps B and C are defined below.

- Ⓑ Submit a Visit Authorization Request (VAR) via JPAS **NO LATER than 13 May 2019.**
SMO Code 0W2X85
POC: JANNAF Security Team
POC Phone: (410) 992-7300
Dates of Visit: 3-6 June 2019
Additional Information: JANNAF Meeting.
- Ⓒ Submit the [JANNAF Security Clearance Certification Form](#) (click to download) **NO LATER than 13 May 2019.**
Return completed form to JHU WSE ERG via:
Fax (410-730-4969)
OR
Mail (JHU WSE ERG, 10630 Little Patuxent Pkwy, Ste 202, Columbia, MD 21044-3286)

IMPORTANT: If your required documentation is not received by 13 May 2019, you WILL NOT be permitted to attend the classified sessions. This is an AFRL-WPAFB incoming visit policy.

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Registration Fee

Register and pay the registration fee by Friday, 31 May at 11:59 p.m. EDT to take advantage of the lowest fee. For details of what the registration fee includes, please go to the [Registration Page](#) of the meeting website. Please reference the registration fee chart below to determine the amount applicable to your registration. The dates noted below are based on payment being *received*.

Payment Received	Regular Attendee	Student*
<i>on or before 5/31/19</i>	\$1,200.00	\$250.00
<i>6/1/19 or later</i>	\$1,350.00	\$250.00

* A discounted registration fee is offered for **full time** students, interns, and cooperative education students. Students must meet the security/attendance requirements noted above and present current student identification upon registration on-site.

Registration payment will be accepted via check payable to JHU WSE Energetics Research Group, purchase order (government only), or by credit card (VISA, MasterCard, American Express) using the Registration Payment site available online. Go to the [Registration Page](#) of the meeting website, and click on “Pay Registration Fee.”

Payment of the registration fee may be completed as soon as permitted, but should be completed on or before Friday, 31 May 2019 to obtain the lowest registration fee. Credit card payments made electronically via the Web will be charged immediately; a receipt will be sent to you via email.

Cancellation Policy

Please note our cancellation policy—
Written (email) cancellations submitted on or before 20 May 2019 will receive a full refund minus an administrative fee of \$50.00. Cancellations made after 20 May 2019 **will not be refunded**. Substitutes are welcome as long as the request for substitution is from the original attendee; attendance eligibility is appropriately met by the substitute; and the original and substitute attendee are from the same organization to facilitate transfer of registration funds. Please contact Shelley Cohen via email to scohen@erg.jhu.edu to transfer or cancel your registration.

On-Site Registration / Check-in

The JANNAF Registration desk will be located on the third floor of the Dayton Convention Center. Photo identification is required upon registration or check-in. The desk will be open Monday, 3 June through Thursday, 6 June, from 7:00 a.m. - 5:00 p.m.

Attention DoD

Based on current conference guidance and consultation with various service conference POCs, there is no longer a need for DoD meeting approval. U.S. Government organizations should following their organization’s internal guidance with respect to meeting attendance. Please note JANNAF functions are accomplished consistent with the approved JANNAF Charter (available on the June meeting website). Questions concerning this should be directed to the TEC Chair, Drew DeGeorge, at drew.degeorge@us.af.mil.

Attire

There is no official dress code for JANNAF conferences; however, business or business casual attire is suggested. When packing, keep in mind that it can be difficult to regulate the temperature in meeting rooms to everyone’s liking, and any changes may not be noticeable quickly, so it is best to bring a sweater or jacket and dress in layers.

Dining

Approximately one and one-half hours for lunch has been built into the program each day. Lunch options include the restaurant in the hotel, View 162, as well as several restaurants in the nearby Oregon Historic District; a map and directory is available on the [Location/Hotel page](#) of the meeting website. Please note that Dayton Convention Center policy prohibits outside food or beverages from being brought into their facility. For those attending classified sessions at WPAFB, a list of nearby food options will be provided.

Networking Room

Rooms 305-306 on the 3rd floor of the Convention Center will serve as the JANNAF networking area; a light continental breakfast and mid-morning coffee break along with mid-afternoon refreshments will be served at the times stated in the program. This area will be open Monday through Thursday from 7:00 a.m. - 5:00 p.m. For those attending classified sessions at AFRL at WPAFB, refreshments will be offered there during breaks as well. Please note that scheduled breaks are included in session agendas where time permits.

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Networking Night

Come enjoy an evening with fellow JANNAF attendees on Wednesday, 5 June from 6:30-8:00 p.m. The location for this event will be announced soon. A cash bar reception will precede the networking event at 6:00 p.m. **There is no charge for meeting attendees**; however, guest tickets may be purchased on the Registration Payment site for \$45 (admission is free for children five and under). Be sure to wear your JANNAF badge to attend the event.

Reading Room

All unclassified papers presented in the technical sessions and received in time will be available to read via JANNAF touch-screen tablets in the Reading Room, located in Room 307. This room will be open Monday through Thursday from 8:00 a.m. - 4:30 p.m. Reproduction of Reading Room papers is not permitted.

Side Meetings

A limited number of meeting rooms of varying sizes are available for JANNAF-related side meetings. Audiovisual equipment will not be provided. Please contact Shelley Cohen at scohen@erg.jhu.edu to reserve a room as soon as possible. Requests may also be made on-site during the meeting. Rooms will be assigned first-come, first-served.

Program Changes

Meeting programs will be distributed to attendees upon registration/check-in on-site. Note that **Final Programs are Distribution Statement C and should be secured when not in your possession**. Changes to the Final Program will be posted on touch screen monitors located on the 2nd and 3rd floors of the Convention Center. Attendees should periodically check for program updates and administrative announcements and note these updates in their copy of the Final Program.

Meeting Proceedings

Proceedings from this meeting will be published by the JHU WSE Energetics Research Group. Unclassified papers, and in limited cases, presentations will be provided complimentary to attendees of this meeting who have paid the full registration fee (early or regular). These attendees will have access to these materials beginning approximately 12 weeks following the meeting via the JANNAF Digital Online Collection (JDOC) Database accessible through your account on the JANNAF Secure Portal. This benefit is not available for student attendees.

Questions

Questions concerning this program and/or payment of the registration fee should be directed to Shelley Cohen at (410) 992-7302, ext. 215 / scohen@erg.jhu.edu OR Gabrielle Delisle at (410) 992-7300, ext. 208 / gdelisle@erg.jhu.edu.

Questions pertaining to registering via the JANNAF Secure Portal should be directed to Mary Gannaway at (410) 992-7304, ext. 211 / mtg@jhu.edu OR Tricia Reider at (410) 992-7300, ext. 222 / treider@erg.jhu.edu.

Upcoming JANNAF Meetings

66th JANNAF Propulsion Meeting
Programmatic and Industrial Base Meeting
49th Combustion
37th Airbreathing Propulsion
37th Exhaust Plume and Signatures
31st Propulsion Systems Hazards
Joint Subcommittee Meeting
3-7 June 2019
Dayton, Ohio

13th Modeling and Simulation
11th Liquid Propulsion
10th Spacecraft Propulsion
Joint Subcommittee Meeting
Programmatic and Industrial Base Meeting
9-13 December 2019
Location TBA

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Program Committee Members

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Dr. David R. Gonzalez
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JANNAF PROPULSION MEETING PROGRAM COMMITTEE

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Mr. Ryan E. Hunter
Naval Air Warfare Center Weapons Division / China Lake, CA

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Mr. Paul J. Conroy
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Lt. Col. Jonathan F. McCall
Air Force Research Laboratory / Edwards AFB, CA

Dr. Charles J. Trefny
NASA Glenn Research Center / Cleveland, OH

Dr. David R. Gonzalez
Naval Surface Warfare Center / Indian Head, MD

Mission Area I: Tactical Propulsion

Dr. Jeremy R. Rice
CCDC Aviation & Missile Center / Redstone Arsenal, AL

Dr. David R. Gonzalez
Naval Surface Warfare Center-IHEODTD / Indian Head, MD

Mission Area II: Missile Defense / Strategic Propulsion

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

Mission Area III: Propulsion Systems for Space Access

Mr. Bruce R. Askins
NASA Marshall Space Flight Center / Huntsville, AL

Mission Area IV: Gun and Gun-Launched Propulsion

Mr. Paul L. Henderson
CCDC Armaments Center / Picatinny Arsenal, NJ

Mission Area V: Propulsion and Energetics Test Facilities

Mr. Michael D. Owen
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Ms. Julie A. Carlile
Air Force Research Laboratory / Edwards AFB, CA

Mission Area VI: Sensors for Propulsion Measurement Applications

Dr. Gary W. Hunter
NASA Glenn Research Center / Cleveland, OH

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

Mr. James L. Cannon
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Mission Area VIII: Digital Engineering [Joint Mission Area with MSS]

Dr. Michael D. Watson
NASA Marshall Space Flight Center / Huntsville, AL

Mission Area IX: Simulation Credibility: Uncertainty, Verification, Validation and Risk [Joint Mission Area with MSS]

Dr. Robert A. Baurle
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Dr. Dean R. Eklund
Air Force Research Laboratory / Wright-Patterson AFB, OH

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Mr. Peter Zeender
JHU WSE Energetics Research Group / Columbia, MD

PROGRAMMATIC AND INDUSTRIAL BASE

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Dr. Christine M. Michienzi
OUSD(AT&L)/DASD, MIBP / Alexandria, VA

PIB Executive Committee Co-Chair

Mr. Robert H. Champion
NASA Marshall Space Flight Center / Huntsville, AL

JHU WSE ERG Technical Representative

Kirk V. Sharp
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Technical Steering Group Deputy Chair

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Program Committee Members - continued

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Sr. Scott A. Felt
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Mission Area III: Explosive Performance / Enhanced Blast

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Dr. Eric J. Welle
Air Force Research Laboratory / Eglin AFB, FL

Mission Area IV: Airbreathing Combustion

Dr. Mark R. Gruber
Air Force Research Laboratory / Wright-Patterson AFB, OH

Mission Area V: Combustion Diagnostics

Dr. Jeffrey S. West
NASA Marshall Space Flight Center / Huntsville, AL

Mission Area VI: Liquid, Hybrid and Novel Propellants Combustion

Mr. Joel W. Robinson
NASA Marshall Space Flight Center / Huntsville, AL

Mr. A. Paul Zuttarelli
Air Force Research Laboratory / Edwards AFB, CA

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Mr. Bryan S. DeHoff
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Mission Area I: Conventional Ramjet Propulsion

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Naval Air Warfare Center Weapons Division / China Lake, CA

Mission Area II: Scramjet Propulsion

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Mission Area III: Scramjet Propulsion / Structures

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Mission Area IV: Scramjet Component Engine Testing

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National Aerospace Solutions / Arnold AFB, TN

Mission Area V: Combined / Advanced Cycle Propulsion

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Mr. Glenn W. Liston
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Mission Area VI: Small / Expendable Turbopropulsion

Mr. Gregory B. Bruening
Air Force Research Laboratory / Wright-Patterson AFB, OH

Mission Area VII: Fuel Technology

Dr. Donald K. Phelps
Air Force Research Laboratory / Wright-Patterson AFB, OH

Mission Area VIII: Component Modeling Simulation

Dr. Mark A. Hagenmaier
Air Force Research Laboratory / Wright-Patterson AFB, OH

Dr. Richard L. Gaffney
NASA Langley Research Center / Hampton, VA

Mission Area IX: Advanced Combustion Control

Dr. Aaron H. Auslender
NASA Langley Research Center / Hampton, VA

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EXHAUST PLUME AND SIGNATURES SUBCOMMITTEE

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CCDC Aviation & Missile Center / Redstone Arsenal, AL

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Mission Area I: Plume/Wake/Hypersonic Flow Field Analysis

Dr. Kevin D. Kennedy
CCDC Aviation & Missile Center / Redstone Arsenal, AL

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

Mr. Jonathan Mautz
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Mission Area III: Exhaust Plume Effects

Dr. Forrest E. Lumpkin
NASA Johnson Space Center / Houston, TX

Mission Area IV: Other Plume/Wake/Hypersonic Related Problems

Dr. Milton E. Vaughn
CCDC Aviation & Missile Center / Redstone Arsenal, AL

Mission Area V: Composite Scene Signatures of Plume/Wake/Hypersonic Flowfield and Hardbody Configurations

Ms. Robin L. Miller
Naval Air Warfare Center Weapons Division / China Lake, CA

PROPULSION SYSTEMS HAZARDS SUBCOMMITTEE

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Mission Area I: Thermal Decomposition and Cookoff

Ms. Aubrey D. Farmer
Naval Air Warfare Center Weapons Division / China Lake, CA

Mission Area II: Shock / Impact-Induced Reactions

Dr. Joel B. Stewart
CCDC Army Research Laboratory / Aberdeen Proving Ground, MD

Dr. William W. Erikson
Sandia National Laboratory / Albuquerque, NM

Mission Area III: Insensitive Munitions Technology

Ms. Jessica L. Vaughn
CCDC Aviation & Missile Center / Redstone Arsenal, AL

Mr. Stephen R. Struck
Air Force Research Laboratory / Eglin AFB, FL

Mission Area IV: Gun Propellant Vulnerability

Mr. J. Kevin Boyd
CCDC Army Research Laboratory / Aberdeen Proving Ground, MD

Mission Area V: Propulsion Systems Safety and Hazard Classification

Dr. Josephine Covino
DoD Explosives Safety Board / Alexandria, VA

Mission Area VI: Energetic Liquid Hazards

Mr. Adam J. Brand
Air Force Research Laboratory / Edwards AFB, CA

JANNAF MEETING MANAGER

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JHU WSE Energetics Research Group / Columbia, MD

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Tricia Reider
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Program Highlights

Keynote Address



Dr. Mark J. Lewis, Director of IDA's Science and Technology Policy Institute in Washington, DC, will present the keynote at this year's conference. The title of Dr. Lewis' address is "**Towards a Coherent National Strategy in Hypersonics**".

Hypersonic systems have been widely recognized as offering promising new military capabilities. In the hands of potential adversaries, they also represent a considerable threat. Hypersonics is more than just speed; in modern parlance, high-lift/low-drag concepts combine speed with maneuverability and trajectories that amplify their survivability and complicate defensive measures. Hypersonics is also more than one system or type of system, with promising technologies that include both airbreathing and rocket propulsion options in both tactical and strategic deployments. Current systems and concepts have varying degrees of maturity, utility, and inherent developmental risk. There are also remaining fundamental research challenges. This talk will review the current state of the art, with an eye towards identifying the attributes of a cross-agency strategy that would maximize military utility with a coherent national portfolio.

IDA's Science and Technology Policy Institute is a federally funded research and development center. Dr. Lewis leads more than 40 researchers providing analysis of national and international science and technology issues for the Office of Science and Technology Policy in the White House, the National Science Foundation, and the National Institutes of Health, among others.

Prior to taking charge of STPI, Dr. Lewis served as the Willis Young, Jr. Professor and Chair of the Department of Aerospace Engineering at the University of Maryland. A faculty member at Maryland for 24 years, Dr. Lewis taught and conducted basic and applied research. From 2004 to 2008, he was the Chief Scientist of the U.S. Air Force. From 2010 to 2011, he was President of the American Institute of Aeronautics and Astronautics (AIAA). Dr. Lewis also served

as a member of the Air Staff and principal scientific adviser to the Chief of Staff and Secretary of the Air Force. He provided assessments on a wide range of scientific and technical issues affecting the Air Force mission.

Dr. Lewis attended the Massachusetts Institute of Technology, where he received a Bachelor of Science degree in aeronautics and astronautics, Bachelor of Science degree in earth and planetary science (1984), and both a Master of Science degree (1985) and a Doctor of Science degree (1988) in aeronautics and astronautics.

Dr. Lewis is the author of more than 300 technical publications and has been an adviser to more than 60 graduate students. He has also served on various advisory boards for NASA, the Defense Department, and the Air Force, including two terms on the Air Force Scientific Advisory Board.

Dr. Lewis is a Fellow of the Royal Aeronautical Society, a Fellow of the American Society of Mechanical Engineers, and an Honorary Fellow of the AIAA. His awards include the DOD Exemplary Civilian Service Award, Meritorious Civilian Service Award, Exceptional Civilian Service Award, the IECEC/AIAA Lifetime Achievement Award, and the Air Force Association's Theodore Von Karman Award. He was also recognized as an AIAA National Capital Young Scientist/Engineer of the Year (1994) and an Aviation Week Laureate (2007).

All attendees are invited to participate. **The Keynote Address begins at 8:00 a.m. on Tuesday, 4 June, in the Theater (312)** on the third floor of the Dayton Convention Center. An awards presentation will immediately follow the Keynote Address.

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Additional Program Highlights

JANNAF Propulsion Meeting

Highlights of the JPM offerings at this meeting include a Specialist Session on the **Development of Rotating Detonation Engine Performance Metrics** (1B); a two-part Specialist Session (2T and 3Q-Part 2) that provides demonstrations of **Hypersonic Propulsion Codes**; and a two-part Specialist Session on **Digital Engineering and Augmented Reality** (3C and 3O).

Programmatic and Industrial Base

The PIB will hold three Specialist Sessions during the June meeting. In session 3P-Part 2 on Wednesday, the topic will be **Return of Large Scale Upper Stage Rocket Thermal-Vacuum and Altitude Hot-fire Test Capability to the U.S.** On Thursday morning, session 4F will address the **PropSIMA Database Analysis and DOC Survey Results**. Thursday afternoon, a Specialist Session on **Launch and Propulsion System Reusability** will be presented in session 4S.

Combustion Subcommittee

With more than 100 papers and presentations in 15 technical sessions and a Workshop, highlights of the CS program include the Workshop on **Propellant Burning Rate Measurement Techniques** on Monday morning (1G). The Workshop is being held as a follow-up to a related activity conducted by the CS in 2018. Among other offerings, the CS portion of the program also includes a two-part session on **Reactive Materials** (4B and 4N), five sessions on **Green and Alternative Propellants** (1O, 2C, 2O, 4C, and 4O), and sessions covering **Explosive Effects** (3D and 3P). The CS will also conduct five panel and town hall meetings.

Airbreathing Propulsion Subcommittee

This year's Airbreathing Propulsion Subcommittee Meeting has a full slate of activities with over 130 papers or presentations planned during 23 sessions, including five sessions on structures and materials. Six of the sessions are Specialist Sessions and include three on **Hypersonic Airbreathing Vehicle Designs and Methods** (1H, 1T, and 3I), as well as the very popular **Hypersonic Programs Overview** (2U). Finally, there is a workshop planned to discuss the status of **MSCC testing at AFRL** (5D).

Exhaust Plume and Signatures Subcommittee

The EPSS will offer several sessions at this JANNAF meeting. Highlights include a session on **Flowfield Modeling, followed by a collaborative discussion between the DoD and NASA on Flowfield Modeling** (1R). Additionally, in collaboration with the Combustion and Airbreathing Propulsion subcommittees, EPSS will offer a Specialist Session and tutorial on **Turbulent Chemistry Effects on Plume Signatures** (3H). Another Specialist Session and tutorial, in conjunction with APS (4I), will focus on **Signature Prediction Techniques for Hypersonic Plume/Hardbody Configurations**.

Propulsion Systems Hazards Subcommittee

During the June meeting, the PSHS will offer a two-part technical session on **Shock/Impact-induced Reactions** (2D and 2P), which is a follow-up to a related activity conducted by the Propulsion Systems Hazards subcommittee in 2018. Also notable is a two-part session on **Energetic Liquid Hazards** (2F and 2R) on Tuesday. The session and panel meeting on **Insensitive Munitions** (4T) on Thursday afternoon will also be of interest.

Some of the top reasons given for attending previous 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.

JANNAF Meeting Invitation - June 2019

Technical Program

This year's technical program currently consists of 50 technical sessions with more than 300 presentations, plus 15 specialist sessions, 3 workshops, and 17 panel, town hall, and working group meetings. A detailed daily schedule of all sessions, workshops, meetings and networking activities is provided below and continues through page 15. Detailed agendas of the technical sessions, specialist sessions, and workshops are listed in the Program Section of the Preliminary Program beginning on page 16 (*JANNAF Secure Portal account required for access*).

A Schedule Color Key has been provided on page 13.

SCHEDULE - Monday, 3 June					
7:00 a.m. - 5:00 p.m.	On-Site Check-In and Registration Desk Open			Convention Center - 3rd Floor	
7:00 a.m. - 5:00 p.m.	I.T. Office Open (for Presenters and Session Chairs needing technical assistance)			Room 301	Open
7:00 a.m. - 8:00 a.m.	Networking Area Refreshments			Rooms 305-306	Open
7:15 a.m. - 7:30 a.m.	Session Chair Meeting (Monday Sessions)			Room 307	Closed
8:00 a.m. - 4:30 p.m.	Reading Room			Room 307	Open
8:00 a.m. - 12:05 p.m.	Monday Morning Technical Sessions, Workshop, and Specialist Sessions				
8:00 a.m. - 11:05 a.m.	IA	JPM	Propulsion and Flight Test Facilities	Room 202	Open
8:00 a.m. - 12:05 p.m.	IB	JPM/MSS	<i>SPECIALIST SESSION:</i> Development of JANNAF Rotating Detonation Rocket Engine Ideal Performance Methods	Room 203	Open
8:00 a.m. - 11:05 a.m.	IE	APS	Ramjet Design and Analysis	Room 303	Open
8:00 a.m. - 11:05 a.m.	IF	EPSS	Flowfield Measurements	Room 304	Open
8:25 a.m. - 11:55 a.m.	IG	CS	<i>WORKSHOP:</i> Propellant Burning Rate Measurement Techniques	Rooms 308-309	Open
8:00 a.m. - 12:05 p.m.	IH	APS	<i>SPECIALIST SESSION:</i> Hypersonic Airbreathing Vehicle Designs and Methods - I	Rooms 310-311	Open
9:35 a.m. - 10:35 a.m.	Networking Area Refreshments			Rooms 305-306	Open
12:00 p.m. - 1:30 p.m.	JPM Planning Meeting			Room 205	Closed
12:00 p.m. - 1:30 p.m.	Lunch Break - <i>On Your Own</i>				
1:30 p.m. - 7:05 p.m.	Monday Afternoon Technical Sessions, Workshop, Specialist Session, and Panel Meetings				
1:30 p.m. - 2:35 p.m.	IM	JPM	Solid Rocket Propulsion Technologies	Room 202	Open
1:30 p.m. - 5:35 p.m.	IN	JPM/PSHS	<i>WORKSHOP:</i> Introduction to the GOTChA Process as Used for Joint Enhanced Munitions Technology Program (JEMTP) - Munitions Area Technology Group (MATG) I	Room 203	Open
1:30 p.m. - 5:35 p.m.	IO	CS	Alternative Propellant Modeling and Characterization	Room 204	Open
1:30 p.m. - 2:35 p.m.	IQ	APS	Scramjet Controls	Room 303	Open
2:35 p.m. - 4:35 p.m.	IQ	APS	<i>PANEL MEETING:</i> Active Combustion Control	Room 303	Open
1:30 p.m. - 5:35 p.m.	IR	EPSS	Flowfield Modeling	Room 304	Open
5:35 p.m. - 7:05 p.m.	IR	EPSS	Collaborative Discussions Between NASA and the DoD	Room 304	Open
1:30 p.m. - 3:35 p.m.	IS	CS	Diagnostics	Rooms 308-309	Open
4:05 p.m. - 5:05 p.m.	IS	CS	<i>PANEL MEETING:</i> Flowfield Diagnostics	Rooms 308-309	Open
1:30 - 4:30 p.m.	IT	APS	<i>SPECIALIST SESSION:</i> Hypersonic Airbreathing Vehicle Designs and Methods - II	Rooms 310-311	Open
1:30 p.m. - 3:35 p.m.	IU	APS	Advances in Airbreathing Propulsion Research (U)	WPAFB-Bldg 146	Open
3:05 p.m. - 4:05 p.m.	Networking Area Refreshments			Rooms 305-306	Open
5:00 p.m. - 7:00 p.m.	<i>WORKING GROUP MEETING:</i> Inflow Profile Effects			Room 205	Closed

JANNAF Meeting Invitation - June 2019

SCHEDULE - Tuesday, 4 June

7:00 a.m. - 5:00 p.m.	On-Site Check-In and Registration Desk Open			Convention Center - 3rd Floor	
7:00 a.m. - 5:00 p.m.	I.T. Office Open (for Presenters and Session Chairs needing technical assistance)			Room 301	Open
7:00 a.m. - 8:00 a.m.	Networking Area Refreshments			Rooms 305-306	Open
7:15 a.m. - 7:30 a.m.	Session Chair Meeting (Tuesday Sessions)			Room 307	Closed
8:00 a.m. - 10:00 a.m.	KEYNOTE ADDRESS: "Towards a Coherent National Strategy in Hypersonics" Dr. Mark J. Lewis, IDA STPI <i>Awards and Announcements</i>			Theater 312	Open
8:00 a.m. - 4:30 p.m.	Reading Room			Room 307	Open
9:30 a.m. - 10:00 a.m.	Networking Area Refreshments			Rooms 305-306	Open
10:00 a.m. - 6:00 p.m.	JANNAF Technical Executive Committee Meeting			Room 206	Closed
10:00 a.m. - 12:05 p.m.	Tuesday Morning Technical Sessions, Plenary, and Town Hall Meeting				
10:00 a.m. - 12:05 p.m.	2A	APS	Characterization and Development of High-temperature Material Systems - I	Room 202	Open
10:00 a.m. - 11:35 a.m.	2B	JPM/CS	Gun Propulsion Modeling	Room 203	Open
10:00 a.m. - 11:05 a.m.	2C	CS	Green Propellants: Test Firing	Room 204	Open
11:05 a.m. - 11:35 a.m.	2C	CS	TOWN HALL MEETING: CS Liquids	Room 204	Open
11:00 a.m. - 12:05 p.m.	2D	PSHS	Shock / Impact-Induced Reactions - I	Room 302	Open
10:00 a.m. - 11:35 a.m.	2E	EPSS	Flowfield Signature Tools	Room 303	Open
10:00 a.m. - 12:05 p.m.	2F	PSHS	Energetic Liquid Hazards - I	Room 304	Open
10:00 a.m. - 12:05 p.m.	2G	APS	Multi-disciplinary Analysis Methods for High-speed Platforms	Rooms 308-309	Open
10:00 a.m. - 11:35 a.m.	2H	JPM/MSS	Digital Engineering - I	Rooms 310-311	Open
12:05 p.m. - 1:30 p.m.	Lunch Break - <i>On Your Own</i>				
1:30 p.m. - 6:05 p.m.	Tuesday Afternoon Technical Sessions, Specialist Session, and Town Hall and Panel Meetings				
1:30 p.m. - 3:35 p.m.	2M	APS	Characterization and Development of High-Temperature Material Systems - II	Room 202	Open
1:30 p.m. - 5:05 p.m.	2N	JPM/CS	Gun Ballistic Simulators and Propellant Characterization	Room 203	Open
5:05 p.m. - 6:05 p.m.	2N	CS	TOWN HALL MEETING: Guns	Room 203	Open
1:30 p.m. - 4:35 p.m.	2O	CS	MON-25 Applications	Room 204	Open
1:30 p.m. - 3:05 p.m.	2P	PSHS	Shock / Impact-induced Reactions - II	Room 302	Open
3:35 p.m. - 4:35 p.m.	2P	PSHS	PANEL MEETING: Shock / Impact-Induced Reactions	Room 302	Open
1:30 p.m. - 6:05 p.m.	2Q	APS	Fuel Technology	Room 303	Open
1:30 p.m. - 4:35 p.m.	2R	PSHS	Energetic Liquid Hazards - II	Room 304	Open
4:35 p.m. - 5:05 p.m.	2R	PSHS	PANEL MEETING: Energetic Liquid Hazards	Room 304	Open
1:30 p.m. - 5:05 p.m.	2S	APS	Rotating Detonation Engine Technologies	Rooms 308-309	Open
1:30 p.m. - 2:35 p.m.	2T	JPM/MSS	SPECIALIST SESSION: Hypersonic Propulsion Codes Demonstration - I	Rooms 310-311	Open
1:30 p.m. - 6:05 p.m.	2U	APS	SPECIALIST SESSION: Hypersonic Programs Overview (U)	WPAFB-Bldg 146	Open
3:05 p.m. - 4:05 p.m.	Networking Area Refreshments			Rooms 305-306	Open

Schedule Color Key

Meeting Services	Concurrent Sessions or Panel Meetings
Networking Opportunities	Session Details
Closed Meetings	Panel, Town Hall, & Working Group Meetings

JANNAF Meeting Invitation - June 2019

SCHEDULE - Wednesday, 5 June

7:00 a.m. - 5:00 p.m.	On-Site Check-In and Registration Desk Open			Convention Center - 3rd Floor	
7:00 a.m. - 5:00 p.m.	I.T. Office Open (for Presenters and Session Chairs needing technical assistance)			Room 301	Open
7:00 a.m. - 8:00 a.m.	Networking Area Refreshments			Rooms 305-306	Open
7:15 a.m. - 7:30 a.m.	Session Chair Meeting (Wednesday Sessions)			Room 307	Closed
8:00 a.m. - 4:30 p.m.	Reading Room			Room 307	Open
8:00 a.m. - 12:05 p.m.	Wednesday Morning Technical Sessions, Specialist Sessions, and Panel Meeting				
8:00 a.m. - 10:05 a.m.	3A	JPM	Technology Development for Space Launch	Room 202	Open
8:00 a.m. - 12:05 p.m.	3B	JPM	Digital Engineering - II	Room 203	Open
8:00 a.m. - 12:05 p.m.	3C	JPM/MSS	<i>SPECIALIST SESSION:</i> Digital Engineering Methods Including Digital Twin and Augmented Reality - I	Room 204	Open
8:00 a.m. - 10:35 a.m.	3D	CS	Explosive Effects - I	Room 302	Open
8:00 a.m. - 11:35 a.m.	3E	APS	Small Turbopropulsion Technology - I	Room 303	Open
8:00 a.m. - 12:05 p.m.	3F	CS	Scramjet Cold-start - I	Room 304	Open
8:00 a.m. - 11:35 a.m.	3G	PSHS	Cook-off	Rooms 308-309	Open
11:35 a.m. - 12:05 p.m.	3G	PSHS	<i>PANEL MEETING:</i> Cook-off	Rooms 308-309	Open
8:00 a.m. - 12:00 p.m.	3H	EPSS/CS/APS	<i>SPECIALIST SESSION:</i> Joint EPSS/CS/APS TUTORIAL - Turbulent Chemistry Effects on Plume Signatures	Rooms 310-311	Open
8:00 a.m. - 11:35 a.m.	3I	APS	<i>SPECIALIST SESSION:</i> Hypersonic Airbreathing Vehicle Designs and Methods - III (U)	WPAFB-Bldg 146	Open
9:35 a.m. - 10:35 a.m.	Networking Area Refreshments			Rooms 305-306	Open
12:00 p.m. - 1:30 p.m.	Lunch Break - <i>On Your Own</i>				
12:00 p.m. - 1:30 p.m.	CS Technical Steering Group Meeting			Room 205	Closed
12:00 p.m. - 2:00 p.m.	PIB Executive Committee Meeting			Room 206	Closed
1:30 p.m. - 5:35 p.m.	Wednesday Afternoon Technical Sessions, Specialist Sessions, and Town Hall and Panel Meetings				
1:30 p.m. - 3:35 p.m.	3M	APS	Experimental Techniques for Extreme Environment Structural Testing	Room 202	Open
1:30 p.m. - 5:05 p.m.	3N	APS	Ramjet Design and Fuel Studies	Room 203	Open
1:30 p.m. - 5:00 p.m.	3O	JPM/MSS	<i>SPECIALIST SESSION:</i> Digital Engineering Methods Including Digital Twin and Augmented Reality - II	Room 204	Open
1:30 p.m. - 3:05 p.m.	3P Part I	CS	Explosive Effects - II	Room 302	Open
3:05 p.m. - 3:35 p.m.	3P Part I	CS	<i>TOWN HALL MEETING:</i> Explosives and Enhanced Blast	Room 302	Open
4:05 p.m. - 5:05 p.m.	3P Part 2	PIB	<i>SPECIALIST SESSION:</i> Return of Large Scale Upper Stage Rocket Thermal-Vacuum and Altitude Hot-fire Test Capability to the U.S.	Room 302	Open
1:30 p.m. - 3:05 p.m.	3Q Part I	APS	Small Turbopropulsion Technology - II	Room 303	Open
4:05 p.m. - 5:35 p.m.	3Q Part 2	JPM/MSS	<i>SPECIALIST SESSION:</i> Hypersonic Propulsion Codes Demonstration - II	Room 303	Open
1:30 p.m. - 5:35 p.m.	3R	CS	Scramjet Cold-start - II	Room 304	Open
1:30 p.m. - 5:05 p.m.	3S	CS	Modeling and Simulation of Solid Propellant Combustion	Rooms 308-309	Open
5:05 p.m. - 5:35 p.m.	3S	APS/CS	<i>TOWN HALL AND PANEL MEETING:</i> Kinetics and Related Aspects of Propellant and Explosives Chemistry	Rooms 308-309	Open
1:30 p.m. - 5:35 p.m.	3U	EPSS	Comparisons Against Measurement (U)	WPAFB-Bldg 146	Open
1:30 p.m. - 5:30 p.m.	<i>APS WORKING GROUP / PANEL MEETING:</i> Pressure Gain Combustion			Room 208	Closed
3:00 p.m. - 4:05 p.m.	Networking Area Refreshments			Rooms 305-306	Open
6:00 p.m. - 8:00 p.m.	Networking Night - Dinner and Cash Bar <i>JANNAF Badge or Guest Ticket required</i>			Crowne Plaza Presidential Ballroom	Open

JANNAF Meeting Invitation - June 2019

SCHEDULE - Thursday, 6 June

7:00 a.m. - 5:00 p.m.	On-Site Check-In and Registration Desk Open			Convention Center - 3rd Floor	
7:00 a.m. - 5:00 p.m.	I.T. Office Open (for Presenters and Session Chairs needing technical assistance)			Room 301	Open
7:00 a.m. - 8:00 a.m.	Networking Area Refreshments			Rooms 305-306	Open
7:15 a.m. - 7:30 a.m.	Session Chair Meeting (Thursday Sessions)			Room 307	Closed
8:00 a.m. - 12:00 p.m.	PIB Liquid Propellant Working Group			Room 205	Closed
8:00 a.m. - 4:30 p.m.	Reading Room			Room 307	Open
8:00 a.m. - 12:05 p.m.	Thursday Morning Technical Sessions, Specialist Sessions, and Panel Meetings				
8:00 a.m. - 11:35 a.m.	4A	JPM	Model Validation and Uncertainty Quantification	Room 202	Open
11:35 a.m. - 12:05 p.m.	4A	MSS	PANEL MEETING: Simulation Credibility	Room 202	
8:00 a.m. - 11:05 a.m.	4B	CS	Reactive Materials - I	Room 203	Open
8:00 a.m. - 11:35 a.m.	4C	CS	Green Propellants: Modeling and Studies	Room 204	Open
8:00 a.m. - 11:05 a.m.	4D	CS	Experimental Solid Propellant / Fuel Combustion	Room 302	Open
8:00 a.m. - 10:05 a.m.	4E	APS	Design Approaches for High-speed Airbreathing Systems	Room 303	Open
10:35 a.m. - 11:35 a.m.	4E	APS	PANEL MEETING: Structures and Materials	Room 303	Open
8:00 a.m. - 12:00 p.m.	4F	PIB	SPECIALIST SESSION: PropSIMA Database Analysis and DOC Survey Results	Room 304	Open
8:00 a.m. - 12:05 p.m.	4G	APS	SPECIALIST SESSION: Recent Progress - Air-Breathing Pressure Gain Combustion	Rooms 308-309	Open
8:00 a.m. - 9:05 a.m.	4H	APS	Scramjet Testing at the Calspan-University at Buffalo Research Center	Rooms 310-311	Open
8:00 a.m. - 11:55 a.m.	4I	EPSS/APS	SPECIALIST SESSION: Joint EPSS/APS TUTORIAL - Signature Prediction Techniques for Hypersonic Plume/Hardbody Configurations (U)	WPafb-Bldg 146	Open
9:30 a.m. - 10:35 a.m.	Networking Area Refreshments			Rooms 305-306	Open
12:00 p.m. - 1:30 p.m.	Lunch Break - <i>On Your Own</i>				
12:00 p.m. - 1:30 p.m.	MSS Technical Steering Group Meeting			Room 207	Closed
12:00 p.m. - 1:30 p.m.	APS Technical Steering Group Meeting			Room 208	Closed
1:30 p.m. - 7:05 p.m.	Thursday Afternoon Technical Sessions, Specialist Session, and Panel Meetings				
2:00 p.m. - 5:35 p.m.	4M	EPSS	Composite Signatures and Environment Effects	Room 202	Open
1:30 p.m. - 3:05 p.m.	4N	CS	Reactive Materials - II	Room 203	Open
3:05 p.m. - 3:35 p.m.	4N	CS	PANEL MEETING: Reactive Materials	Room 203	Open
1:30 p.m. - 4:35 p.m.	4O	CS	Green Propellants: Hardware and Performance	Room 204	Open
1:30 p.m. - 6:05 p.m.	4P	APS	Advanced and Combined Cycle Engines	Room 302	Open
1:30 p.m. - 5:05 p.m.	4Q	APS	Recent Scramjet Testing	Room 303	Open
5:05 p.m. - 6:05 p.m.	4Q	APS	PANEL MEETING: Engine Test and Validation	Room 303	Open
1:30 p.m. - 5:35 p.m.	4R	APS	Component Modeling Simulation	Room 304	Open
5:35 p.m. - 6:35 p.m.	4R	APS	PANEL MEETING: Component-level and Physical Modeling	Room 304	Open
1:30 p.m. - 5:00 p.m.	4S	PIB	SPECIALIST SESSION: Launch and Propulsion System Reusability	Rooms 308-309	Open
1:30 p.m. - 4:35 p.m.	4T	PSHS	Insensitive Munitions Technology	Rooms 310-311	Open
4:35 p.m. - 5:20 p.m.	4T	PSHS	PANEL MEETING: Insensitive Munitions Technology	Rooms 310-311	Open
3:05 p.m. - 4:05 p.m.	Networking Area Refreshments			Rooms 305-306	Open
6:00 p.m. - 8:00 p.m.	PSHS Technical Steering Group Meeting			Room 205	Closed
6:00 p.m. - 8:00 p.m.	EPSS Technical Steering Group Meeting			Room 207	Closed

SCHEDULE - Friday, 7 June

8:00 a.m. - 12:05 p.m.	5D	APS	WORKSHOP: AFRL MSCC Test Status	Rooms 302-303	Open
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