

JANNAF

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



NEWS

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Long Beach to Host Spring 2018 JANNAF Meeting

JANNAF heads west to Long Beach, Calif., for the May 2018 JANNAF Meeting. The meeting will be held at the Long Beach Hilton from May 21-24, 2018, and will feature a joint gathering of the 65th JANNAF Propulsion Meeting (JPM) and the 12th Modeling and Simulation (MSS), 10th Liquid Propulsion (LPS), and 9th Spacecraft Propulsion (SPS) Subcommittees, as well as a meeting of the Programmatic Industrial Base (PIB). The Long Beach meeting will be chaired by Major Luke Dras, with the Air Force eSchool of Graduate PME, Maxwell AFB, Ala.

Highlights of the May 2018 JANNAF Meeting include panels on modeling credibility, specialist sessions addressing university liquid-propulsion rocket projects and combustion stability, and a two-part SPS workshop on electrical propulsion (EP).

Roberta Ewart, Chief Scientist, Space and Missile Systems Center (SMC), Air Force Space Command, Los Angeles AFB, Calif., will serve as the keynote speaker on Tuesday, May 22. Ewart will present a three-part presentation entitled, "Novel Orbits for



Major Luke Dras, Air Force eSchool of Graduate PME, Maxwell AFB, Ala., will chair the JANNAF meeting in Long Beach, Calif.

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The JHU WSE Energetics Research Group (ERG) is the technical support contractor of the Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee. The purpose of JANNAF is to solve propulsion problems, affect coordination of technical programs, and promote an exchange of technical information in the areas of missile, space, and gun propulsion technology.

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Recent ERG Publications

VOLUMES

- Abstract Number: 2017-0009
JANNAF Journal, Volume 8, Issue 1
Dec 2017

PANEL DOCUMENTS

Abstract Number: 2017-0008
Launch Vehicle, Missile, and Spacecraft Plume-Induced Environments
(JANNAF EPSS)
Dec 2017

PROCEEDINGS

- Abstract Number: 2017-0007
Meeting Proceedings from the "48th CS / 36th APS / 36th EPSS / 30th PSHS / PIB" (Newport News, VA)
Dec 2017
- All panel documents and meeting proceedings are available in the JANNAF Digital Online Collection (JDOC) database, accessible through the JANNAF website (<https://www.jannaf.org/>).

ERG's Technical/Bibliographic Inquiry Service

ERG offers a variety of services to its subscribers, including responses to technical/bibliographic inquiries. Answers are usually provided within three working days, in the form of telephoned, faxed, electronic, or written technical summaries. Customers are provided with copies of JANNAF papers, excerpts from technical reports, bibliographies of pertinent literature, names of recognized experts, propellant/ingredient data sheets, computer programs, and/or theoretical performance calculations. The ERG staff responds to numerous inquiries each year, from over 150 customer organizations. For further information, please contact David Owen by email at dowen@erg.jhu.edu.

ERG Subscriptions

ERG forwarded GFY 2017 subscription renewal packets to its customer base for continued products and services. We would like to take this opportunity to inform the community that a minimum subscription of \$1,775 entitles subscribers to one complimentary suite of JANNAF databases; one complimentary *JANNAF Journal*; and six hours (prepaid) of technical/bibliographic inquiry hours. For information concerning an ERG subscription and/or products and services, please contact Tricia Reider at 410-992-7300, ext. 222, or email treider@erg.jhu.edu. You may also visit <https://www.erg.jhu.edu/subscriptions>.

JANNAF Meeting, Long Beach, California... *continued from page 1*

Guardians of the High Frontier.” The keynote will address the need for modeling and simulation of novel orbits; how in-space propulsion will change to support novel orbits; and how current SMC technology efforts are underway to devise the technology to support novel orbits to ensure that the U.S. maintains an asymmetric advantage in the contested space domain.

Ewart graduated with a degree in Physics from the United States Air Force Academy and earned the Air Force’s first ever Marshall Scholarship to Oxford University in the United Kingdom. At Oxford, she earned master’s degrees in Theoretical Physics and the Philosophy of Science. She also served on two championship rowing teams. Later, she earned a master’s degree in Electrical Engineering with a focus on electro-optics and satellite design from the University of Colorado. She then earned a Degree of Engineer (DE) from Stanford University in Electrical Engineering with a focus on advanced low noise laser systems. She was competitively selected by SMC as its first chief scientist in 2006. In this capacity, she serves as the SMC’s principal scientific authority and supports the SMC leadership in assessments of advanced technology. Her primary duty is to advance the knowledge of emerging technologies for improving Air Force space capabilities.

The three technical subcommittees meeting in Long Beach have organized numerous paper sessions, specialist sessions, panels, and workshops that will be of interest to the JANNAF community. MSS sessions will cover a variety of topics including systems-level engineering using predictions from models; methods for analyzing results from these models; specific examples of how model-based systems engineering has been implemented in real-world systems; systems integration of subsystems; systems health monitoring; slosh modeling; model uncertainty quantification; sensor development and modeling; modeling analysis for state-of-the-art propulsion technologies, as well as hands-on experience using propulsion modeling tools.

The MSS will host regular paper sessions and the Integrated Health Management (IHM), Simulation Credibility (SC), and Model Based Systems Engi-



Roberta Ewart, Chief Scientist, Space and Missile Systems Command, Air Force Space Command, Los Angeles AFB, Calif., will be the keynote speaker at the JANNAF Meeting in Long Beach, Calif.

neering (MBSE) panels will each hold their regular meetings to discuss progress and improvements in the areas of simulation techniques; model development; sensors and applications; and verification, validation, and uncertainty quantification for simulations.

The Simulation Credibility, Verification, Validation, and Risk panel’s overall objective is to facilitate credible modeling and simulations, ranging from hard computing to soft computing and knowledge-based computing. The panel released a Simulation Credibility guide at the December 2016 JANNAF meeting in Phoenix, Ariz. This guide focused on advances in verification, validation, and uncertainty quantification of models. With the release of this guide, a workshop will be held at the May 2018 meeting to discuss approaches to computing uncertainty quantification models. This workshop will be example-based and will include how differing fields incorporate their ale-

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JANNAF Meeting, Long Beach, California... *continued from page 3*

atory and uncertainty sources into their uncertainty quantification models. A separate technical session will focus attention on uncertainty quantification results and approaches.

The MBSE panel's objectives are to develop methodologies, codes, and simulations to quantitatively evaluate and optimize propulsion technologies, usu-

ally at a system level. At this meeting, the panel will focus on advances in spacecraft modeling and simulation approaches, propellant slosh modeling, and analytical approaches to system-level models for state-of-the-art propulsion technologies. Such technologies include electrical propulsion plume simulations, conceptual designs for liquid rocket engines

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Why Should You Attend a JANNAF Meeting?

The most recent JANNAF meeting, held in Newport News, Va., in December 2017, was the most well attended meeting in recent years. There were 481 attendees, with 267 from government organizations including NASA, the U.S. Army, the U.S. Air Force, and the U.S. Navy; 190 attendees from industry; and 24 from academia.

Evaluation results from the recent meeting revealed that technical content and networking opportunities were the most valuable aspects of the meeting. More than half of the responses from meeting attendees stated that networking and other interactions during the meeting were very useful to them.

Below, please see a sampling of some of the anonymous comments found in the evaluation results regarding the aspects attendees found most valuable about JANNAF meetings:

"JANNAF meetings are like coming home to the core group of customers and researchers doing similar work to yourself. Being able to converse on these subjects stimulates further ideas."

"The ability to speak directly with the lead developer of a software product that I use. Also, I saw a certain presentation in which a researcher solved a problem that I have a large interest in."

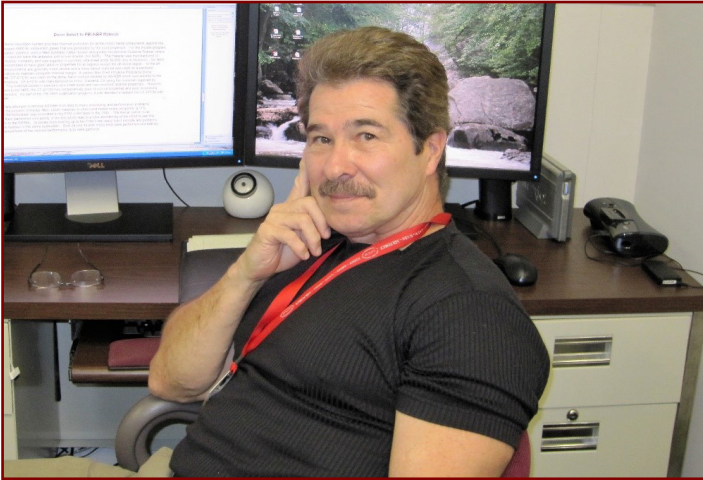
"The ability to work face to face with people doing the same things. Understanding what the rest of the agencies are doing that is related to my research. We are not subjected to all of the sales and marketing that other conferences allow. It is distracting."

"JANNAF meetings provide an opportunity to present Distribution C information to a receptive audience. These meetings are essential to keeping up with what's going on in the field."

"This JANNAF meeting provided an extremely valuable opportunity to bring together established developers and technical leaders in the field with first time attendees. It allowed for the free exchange of professional, technical, and personal dialogue necessary to re-invigorate and continue a focused community of professionals dedicated to meeting similar goals. It also presented opportunities for civilian and defense personnel to find common ground."

Many people also noted that JANNAF provides the only venue for publishing ITAR material, especially research for the hypersonics community.

In Memoriam



Jeppy Louis Clayton (1956-2018)

The JANNAF community is deeply saddened to learn of the passing of Jeppy Louis Clayton, NASA Marshall Space Flight Center, on March 6, 2018, at the age of 62 due to complications from influenza. Born and raised in Gadsden, Ala., Clayton graduated from Emma Sansom High School in 1974 and went on to earn Bachelor's and Master's Degrees in Mechanical Engineering from Auburn University. He later went to work for NASA and had been at the agency for 29 years at the time of his death.

Clayton was an active member in the JANNAF community and served as the primary author of over a dozen JANNAF papers related to rocket nozzle technology. He supported the Rocket Nozzle Technology Subcommittee (RNTS) from 1999 to the present in a variety of capacities including:

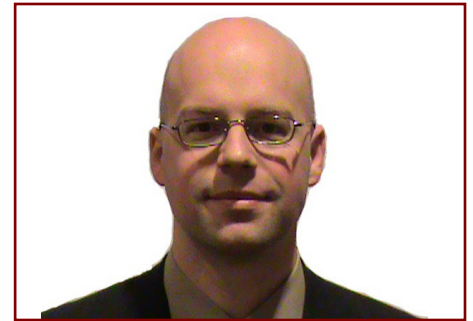
- NASA Representative on the Technical Steering Committee, serving as Chair and Deputy Chair since 2007
- RNTS Mission Area Chair for Thermal, Structural, and Fluid Analysis and Modeling
- Chair and Co-chair on the Nozzle, Design, Test, and Evaluation and Nozzle Analysis and Modeling Panels
- Chair of multiple Advanced Thermal/Structural Modeling of Carbon Cloth Phenolic Workshops, making great strides in this area with each workshop conducted; and
- Served as a Session Chair at numerous RNTS Annual Meetings.

Clayton was unable to attend the 31st RNTS Meeting in Kansas City, Mo., in May 2017 due to a scheduling conflict with a vacation to Alaska. At the Technical Steering Group meeting during the 31st RNTS Meeting, Clayton was nominated—and enthusiastically approved by unanimous agreement—to receive a RNTS Lifetime Achievement Award, to be presented to him at the 32nd RNTS Meeting in December 2018. True to his humble and kind character, when informed of this, Clayton responded, “Thanks—it is nice to be noticed. Hope you are doing well.”

Clayton is survived by his wife, Leeann, daughter, Jessica, brother, Danny, three nephews, two nieces, and various other family members.

ERG Bids Farewell to Andrew Taylor

ERG Technical Representative Andrew Taylor has accepted a new position with the U.S. Army at Aberdeen Prov-



Andrew Taylor

ing Ground, Md., effective March 2018. For more than eight years, Taylor ably supported the Propellant and Explosives Development and Characterization (PEDCS) and Propulsion Systems Hazards (PSHS) Subcommittees. ERG Technical Representative William Bagley will be taking over Taylor's responsibilities with PEDCS and ERG Technical Representative Tom Alsbrooks will be taking over Taylor's responsibilities with PSHS. We wish Andy all the best with his new job!

JANNAF News is seeking short (Dist A) technical articles for future editions.

If you are interested in submitting an article or have any questions, please contact Managing Editor Benjamin Schwantes at bschwantes@erg.jhu.edu

JANNAF Programmatic & Industrial Base Panel Meeting

A new JANNAF Programmatic & Industrial Base (PIB) panel has been established to support the PIB Large Liquids Working Group and the PIB Small Liquids Working Group. The JANNAF PIB Commodities Panel is tasked with industrial base awareness and responsiveness to program requirements for space launch for related commodities: oxygen, hydrogen, RP kerosene, methane and liquefied natural gas, helium, hydrazine, and so forth. At each JANNAF Meeting, the Commodities Panel will provide an update on availability of critical resources to the space launch industry, including supply chain disruptions, possible new suppliers, pricing, and new products.

To accomplish the panel's goals, an initial task on methane and LNG as a space launch propellant has been started. The panel will gather input on program requirements (or needs) related to methane and LNG as a space launch propellant. These needs could include procurement strategies; logistical and facilities challenges or unknowns associated with methane and LNG; safety and handling requirements or unknowns associated with methane and LNG; propellant specification questions, especially with respect to LNG; technical needs for liquid rocket engine development and certification; and space launch vehicle propellant requirements.

The Commodities Panel at the PIB meeting in Long Beach, Calif., will focus on gathering information and providing a status update to the community on the methane and LNG task. Attendance at the panel meeting will be open to registered participants of the May 2018 JPM.

Meeting Goals:

- Identify & share the current state of knowledge and available data on LNG and methane as a space launch propellant.
- Identify missing data and/or risk items associated with LNG and methane as a space launch propellant.

- Identify areas of potential shared interest which would benefit from U.S. Government investment. Areas of potential benefit may include, but are not limited to: data needs; infrastructure needs; procedural, safety, or other requirements necessary to ensure safe and efficient space launch activities.

Benefit to Industry

Attendees are encouraged to identify critical needs for which they believe government investment will be beneficial to the industry as a whole. The PIB Commodities Panel will solicit this feedback throughout the meeting and will compile the results for the JANNAF PIB Executive Committee (PEC). The PEC is responsible for providing this information to key decision makers within the DoD and NASA; Critical needs and areas of mutual benefit to industry and government will be highlighted.

The *JANNAF Journal of Propulsion and Energetics* is seeking reviewers and associate editors with knowledge of rotating detonation engine (RDE) technology.

If you are interested in reviewing RDE manuscripts, please contact:

Managing Editor Benjamin Schwantes at
bschwantes@erg.jhu.edu

JANNAF Holds December 2017 Meeting in Newport News, Va.

Newport News, Va., provided the setting for a meeting of the 48th Combustion (CS), 36th Airbreathing Propulsion (APS), 36th Exhaust Plume and Signatures (EPSS), and 30th Propulsion Systems Hazards (PSHS) JANNAF Subcommittees, along with a meeting of the Programmatic and Industrial Base (PIB). Kevin Ford, Ph.D., Naval Air Warfare Center Weapons Division (NAWCWD), China Lake, Calif., chaired the meeting, which included a keynote address and panels, workshops, and specialist sessions hosted by the subcommittees in attendance.

Thomas Boggs, a Scientist with Naval Systems, Inc., in China Lake, Calif., presented an engaging and thoughtful keynote entitled “Fifty-Four Years at China Lake—Lessons Learned” that focused on his 42 years in government service at NAWCWD, China Lake, Calif., and then his 12 years as a government contractor at the same facility. Boggs discussed the circumstances that led him to China Lake as a young University of California, Berkeley, undergraduate and then his gradual rise through the ranks from Scientist, to Branch Head, to Division Head, and eventually to Chief Scientist for Energetics. He shared some of the practical advice he had acquired during his career related to topics such as integrity, zest for life, risk-taking, and leadership. Boggs also offered examples that illustrated his science-based, data-driven approach to researching energetics topics. For young JANNAF participants, he stressed the importance of preparation prior to conducting research, writing papers, and giving presentations. He also highlighted the importance of developing simple standard operating procedures and ensuring they are observed at all times. Boggs concluded by stressing the importance of dedicated colleagues and the necessity of looking out for those under one’s direct chain of command.

Following Boggs’ keynote address, PIB co-chairs Christine Michienzi, Ph.D., Office of the Secretary of Defense for Acquisition, Technology, and Logistics, Manufacturing and Industrial Base Policy, the Department of Defense (DoD) and Michael Kynard, Deputy Director,



Keynote speaker Thomas Boggs, a Scientist with Naval Systems, Incorporated, China Lake, Calif.

NASA Michoud Assembly Facility, spoke briefly about the PIB’s ongoing activities within JANNAF, including publication of the *Integrated Program Plan and Key Decision Point* report, the expansion of the PIB’s Test and Evaluation (T&E) Working Group, and the various PIB sessions at the December meeting that addressed topics such as thrust vectoring, a Department of Commerce survey on the U.S. rocket propulsion industrial base, and launch vehicle reusability. After Michienzi and Kynard spoke, Robert Mercier of the JANNAF Technical Executive Committee (TEC) promoted the *JANNAF Journal* and encouraged attendees to consider submitting papers to the limited-distribution publication. Mercier also presented a commendation to the NASA Langley Research Center (LaRC) from the JANNAF TEC for hosting secure sessions at the 2016 and 2017 JANNAF Meetings in Newport News, Va. CS Chair Heather Hayden, Ph.D., Naval Ordnance Safety and Security Activity, Indian Head, Md., presented a CS Best Technical Paper Award from the 2016 JANNAF Meeting to Alexandra Rein-

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JANNAF Meeting, Long Beach, California... *continued from page 4*

and hypersonic vehicles, as well as slosh-dampening models and predictions. A short specialist session will be held to highlight how MBSE was used on NASA's Europa Mission. This specialist session will offer an opportunity for attendees to learn more about MBSE and will highlight the positive impact that integrating MBSE with traditional experiments can have on project designs.

The IHM panel (joint with JPM and LPS) will focus on system health modeling and implementation and control of sensors, diagnostics, and prognostics. This meeting will focus heavily on solid rocket motor health, including sensor placement, diffusion, and performance models, but will also talk about combustion analysis of liquid rocket engines. The IHM panel will also host a workshop on the *Sensor and Sensing System Handbook*. This handbook is an overarching guide for the development of sensors for aerospace propulsion systems, and it will be discussed in detail during the workshop.

The MSS will also host a specialist session on specific propulsion modeling tools, (such as ROCKETS, HERO, and Fluid Structure Integration). This specialist session will include a hands-on demonstration during which the audience will be able to observe in real time how to use each of these tools. The goal of the session is to enable participants to obtain a fundamental understanding of each modeling tool in order to promote a deeper understanding of their uses, assumptions, and limitations. Ideally, audience members will leave the session equipped with the necessary knowledge to enable them to delve more deeply into these modeling tools and code developments.

The LPS sessions will cover a wide variety of topics including liquid rocket engine systems' analysis, combustion subsystems and components, propellant feed and pressurization systems, along with advanced materials for all of these applications. Within these overarching topics, specific paper sessions at the May 2018 JANNAF Meeting will cover topics

such as combustion stability and dynamics, modeling and best practices for propellant tank and feed system design, pressurization systems design, additive manufacturing component development and testing, oxygen-rich combustion developments, turbomachinery developments, linear and rotating detonation engines design and testing, and the characterization of hydrocarbon fuels.

For those interested in becoming more involved with the LPS community, panel meetings will offer an opportunity to participate in discussions of more specific topics. The following panels will have meetings to discuss their current tasks and progress: Combustion Stability, Advanced Materials, Test Practices and Standards, Hydrocarbon Fuels, and Turbomachinery. Also of note are two specialist sessions at the LPS meeting. The first will cover University Rocket Projects, and the second will detail the Combustion Stability CPIA 655 revision effort being led by the Combustion Stability panel. The specialist session on University Rocket Projects will offer a chance for students to highlight their work, discuss ongoing projects in liquid-propulsion rocket engines, and engage with the propulsion community. The specialist session on the CPIA 655 revision effort will address suggested changes to the first revised draft and also present a second revised draft of the CPIA 655 guidelines.

The SPS is holding a two-part workshop on Electric propulsion (EP), which is a growing area within the commercial satellite sector of the U.S. Government. To date, EP systems have successfully operated on hundreds of satellites. However, there are instances where measured thrust levels and other fundamental characteristics diverge between flight and ground tests; detailed explanations for the differences have not been established. To fully exploit this pervasive space technology, it is prudent to leverage existing flight data and community-wide expertise to enhance predictive capabilities and reduce risk for future missions. This will improve evalua-

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tion of existing EP systems for innovative mission applications and support development of advanced EP technologies for future space capabilities. To this end, a working group called Electric Propulsion Operation in the Space Environment (EPOSE) was formed, with a goal of understanding and mitigating facility effects in the testing and characterization of EP devices, and thereby supporting transition of EP technologies to flight. The workshop will be held on Thursday at 8 a.m. and 1 p.m.

There will also be three panel meetings on the following topics: Smallsat propulsion; electric propulsion; and development needs in modern chemical spacecraft propulsion systems.

Another area that is of interest to watch this year for the SPS is the emergence and advancements that have been made with green monopropellants. The Green Propellant Infusion Mission (GPIM) is expected to launch this year and it will be the first flight test of the AF-M315E green propellant propulsion system.

For complete details on all the papers and topics that SPS and the other technical subcommittees will be covering at the May 2018 JANNAF Meeting, please see the meeting program which is available through the JANNAF portal at <https://www.jannaf.org/node/199>.



Participants in Networking Night at the December 2017 JANNAF Meeting in Newport News, Va.



Participants in Networking Night at the December 2017 JANNAF Meeting in Newport News, Va.

**45th SMBS / 41st PEDCS / 32nd RNTS / 30th SEPS / PIB
December 10-14, 2018**

Portland, Ore., Metropolitan Area

Questions

Technical questions may be addressed to the following ERG technical representatives:

- PIB – Kirk Sharp (ksharp@erg.jhu.edu / 228-234-5423)
- SMBS – Tom Alsbrooks (talsbrooks@erg.jhu.edu / 443-718-5012)
- PEDCS – William Bagley (wbagley@erg.jhu.edu / 443-718-5009)
- RNTS – David Owen (dowen@erg.jhu.edu / 443-718-5006)
- SEPS – William Bagley (wbagley@erg.jhu.edu / 443-718-5009)

For all other meeting-related matters, please contact Shelley Cohen (scohen@erg.jhu.edu / 410-992-7302).

JANNAF JOURNAL OF PROPULSION AND ENERGETICS

The Call For Papers is Ongoing

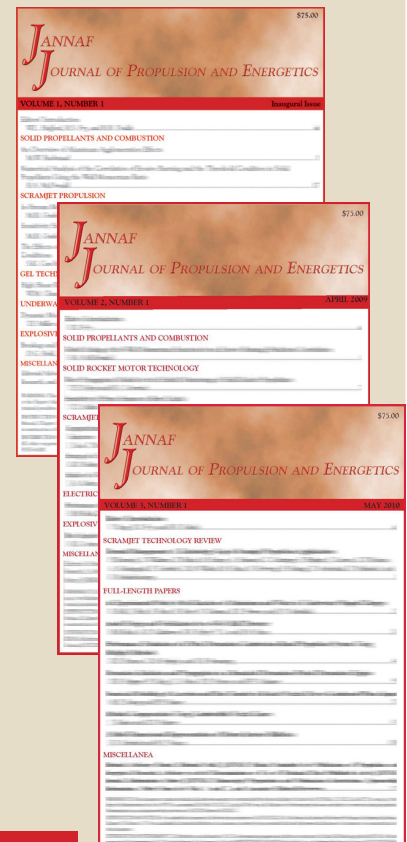
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Robert Mercier (far right) presents a JANNAF commendation to NASA Langley Research Center (LaRC) staff in recognition of LaRC hosting secure sessions at the 2016 and 2017 JANNAF Meetings.



CS Chair Heather Hayden (left) presents the 2016 Combustion Subcommittee Best Technical Paper Award to Alexandra Reinert, Ph.D. (center), and Richard Lee, Ph.D. (right), as well as Joshua Felts, James Rocco, Justin Roybal, and Kent Rye, who could not attend.



APS Chair Lawrence Huebner (left) presents a JANNAF Lifetime Achievement Award to Vincent Rausch (right). Huebner also presented a JANNAF Lifetime Achievement Award to Thomas Kaemming, who could not be present at the awards ceremony.



PSHS Chair Jamie Fisher (right) presents a JANNAF Lifetime Achievement Award to Douglas Kooker, Ph.D. (left).

ert, Ph.D., Naval Surface Warfare Center, Indian Head, Md., Joshua Felts, Naval Surface Warfare Center, Indian Head, Md., Richard Lee, Ph.D., Naval Surface Warfare Center, Indian Head, Md., James Rocco, Applied Research Associates, Incorporated, Albuquerque, N.M., Justin Roybal, Defense Threat Reduction Agency, Kirkland AFB, N.M., and Kent Rye, Naval Surface Warfare Center, Indian Head, Md. After Hayden presented her award, Lawrence Huebner, NASA Marshall Spaceflight

Center, in his capacity as APS Chair, presented an APS Best Technical Paper Award from the 2016 JANNAF Meeting to Daniel Micka, William Audette, and Darin Knaus of Creare, LLC, and Jeffrey Donbar, Air Force Research Laboratory (AFRL), Wright-Patterson AFB, Ohio. Huebner also presented two JANNAF Lifetime Achievement Awards, the first to Vincent Rausch, NASA LaRC, and the second to Thomas Kaemming, Innovative Scientific Solutions, Inc. Finally, PSHS Chair Jamie

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PSHS Chair Jamie M. Fisher (right) presents a PSHS Certificate of Appreciation to Stephen R. Struck (left).

Fisher, AMRDEC, Redstone Arsenal, Ala., presented a JANNAF Lifetime Achievement Award to Douglas Kooker, Ph.D., Bennett Aerospace, Incorporated, Aberdeen Proving Ground, Md. She also presented a Certificate of Appreciation to Stephen Struck, AFRL, Eglin AFB, Fla., and a Sustained Contribution Award to Kevin Ford, NAWCWD, China Lake, Calif.

The four JANNAF Technical Subcommittees that met in Newport News held many interesting and informative workshops, panels, and specialist sessions during the four-day meeting. The Combustion Subcommittee presented the latest work in combustion topics ranging from gun to satellite propulsion, as well as provided multiple opportunities for the community to interact with the subject matter experts working with these various systems.

As in past JANNAF Meetings, CS held town hall meetings, rather than specific panel meetings. These town hall meetings addressed broad combustion topics, such as guns, liquids, solids, explosives, and enhanced blast. These town hall discussions help to capture a significant cross-current of discussion that the Subcommittee Panel Chairs and Mission Area Leads then use to structure near-term activities, workshops, and future calls for papers.

One of the CS town hall meetings that is always well



PSHS Chair Jamie M. Fisher (right) presents a PSHS Sustained Contribution Award to Kevin P. Ford (left).

attended is the joint town hall with APS. This meeting alternates between a CS session and an APS Session. This year, the discussion included the need for a workshop on a central chemical kinetics database, relevant to each of the types of combustion utilized in propulsion systems today. This project would include a set of validation problems and demonstrations at future JANNAF meetings.

APS held a full week of sessions dealing with hypersonics, rotating detonation engines, scramjets, ramjets, and materials development and testing. With 17 separate sessions, plus follow-on workshops, panel meetings and town hall meetings, the JANNAF Community was fully engaged in sharing the current status of projects and planning responses to contemporary challenges in all aspects of airbreathing propulsion. Panels, workshops, and a joint APS/CS town hall meeting provided each of the active areas of the JANNAF subcommittee with opportunities to discuss and make progress on the tasks that they have committed to advancing for their subject areas. High-speed testing represented the grand challenge facing the APS community. Reducing the time between testing and post-test analysis was another area of particular concern. The APS Technical Steering Group (TSG) also addressed the transition process as new chairs took over several panels.

This year EPSS hosted a series of eight tutorials on the

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process of performing flowfield and signature predictions. These physics-based tutorials included: overall considerations, rocket engine/motor considerations, continuum nozzle and plumes, rarefied flow, radiative transfer, environment effects, and EO/IR hardbody and plume signatures.

In addition to the tutorials, EPSS members presented 34 papers in five technical sessions and two workshops. The first workshop identified areas of commonality in technology, applications, and methods between the plume and signatures community and the launch vehicle and airbreathing propulsion community. Topic areas discussed included plume flowfields, plume-induced thermal and aerodynamic effects, and signatures topics of interest to both NASA and the DoD.

The second workshop, which was held at the classified level, highlighted the diverse community of practitioners across the nation who have a vested interest in the continued existence and advancement of plume/wake/hypersonic flowfield and signature modeling capabilities. High-level presentations on the need for model development and predictive capabilities were made. A road map to increase awareness of the current state of the art and critical nature of the technology was also discussed and will be integrated into a briefing to senior DoD leadership.

PSHS held four days of technical and specialist sessions, and five panel meetings. There were 46 presentations spread across nine technical sessions and a further eight presented at the Fire Protection specialist session. The sessions encompassed many of the critical mission areas of the PSHS community and included: thermal decomposition and cookoff; impact/shock induced reactions; insensitive munitions technology; propulsion systems safety and hazard classification; and energetic liquid hazards. PSHS also held a joint session with CS focused on gun propellant characterization.

PSHS kicked off their meeting on Monday, December 4, with the first of two sessions on insensitive munitions (IM) technology co-chaired by Benjamin Wilde, Ph.D., and Stephen Struck of the AFRL, Eglin AFB, Fla. Topics covered in the session included development of thermally-stable, reduced-smoke propellants, initiation experiments and modeling, and IM mitigation technologies. Following the session, Josephine Covino,

Ph.D., from the Department of Defense Explosives Safety Board (DDESB) hosted the “Safety and Hazard Classification” panel meeting. Topics of discussion during the panel meeting included the potential need for a risk-based citing tool for storage, risk-based hazard classification, and the status of TB700-2.

Monday afternoon also included a specialist session entitled, “Fire Protection,” co-chaired by J. Kevin Boyd and Barrie Homan, Ph.D., from the Army Research Laboratory. Boyd provided an overview of the topic, which included vehicle survivability, energetics, active areas in fire protection, and a summary of fire protection workshops. Participants presented work on the topics of fire suppression, modelling, fuel additives, and characterization studies.

Two PSHS sessions focused on cook-off hazards. Cynthia Romo, co-chair of the first cook-off session, from NAWCWD commented “A lot of work is being done involving the coupling of computational models and live experiments to determine hazards. If perfected, this approach could save time and money. Furthermore, the applications of these methods could benefit not only the hazards community, but also the scientists and engineers in charge of coming up with new formulations and weapon systems.”

Aubrey D. Farmer, NAWCWD, chaired the JANNAF Cook-off Panel meeting, held Thursday afternoon following the Cook-Off II/Hazard classification session. Discussions included the announcement that propane had been approved for fast cook-off tests. In addition, the session also addressed the challenges associated with modeling reaction violence and the process of scaling up small-scale tests.

Stephen Struck hosted the IM Technologies panel where he presented information on the status of NATO Standardization Agreements (STANAG) and provided updates on allied ordnance publications (AOP). During the meeting, Struck provided an overview of challenges related to determining the appropriate heating rate for the slow cook-off tests, the necessary soak temperature, the maximum temperature, and the design of the oven. The Third Custodial Working Group meeting is planned for April 9, 2018.

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