

JANNAF

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



NEWS

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JANNAF to Highlight Technical Accomplishments and Discoveries at its December Meeting in Salt Lake City, Utah

The December 2015 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF), which will consist of the Programmatic and Industrial Base meeting; and the Joint Meeting of the 43rd Structures and Mechanical Behavior, 39th Propellant and Explosives Development and Characterization, 30th Rocket Nozzle Technology, and 28th Safety and Environmental Protection Subcommittees, will be held Monday through Thursday, 7 – 10 December 2015, at the Salt Lake Marriott Downtown at City Creek Hotel in Salt Lake City, Utah. Currently, the program includes 43 technical sessions with more than 200 presentations, along with six workshops, four specialist sessions, and 19 panel meetings and a two-day training session.

There is no doubt that attendees at JANNAF meetings learn about a wide range of current research and development activities in their respective areas of expertise while participating in the scheduled technical sessions, workshops, and specialist sessions. But along with the meeting's scheduled content, many additional opportunities occur for networking and collaboration when 350 rocket scientists assemble in the same space.

Sometimes, it is the spontaneous gathering of new acquaintances between sessions that prove to be the

most productive time spent during the meeting. And sometimes, connections made during workshops or panel meetings result in future cooperative partnerships. Scheduled networking opportunities at the December meeting include the three daily breaks (Tuesday through Thursday, plus two breaks on Monday) in the attendee networking room, as well as the Networking Night Dinner on Wednesday, which is included with the registration fee. Daily lunch breaks offer attendees the chance for unstructured conversation in a casual and relaxed setting, either in the hotel's restaurant, or at one of the many nearby dining options. And when sessions and meetings are over for the day, downtown Salt Lake City has many wonderful restaurants to select from as

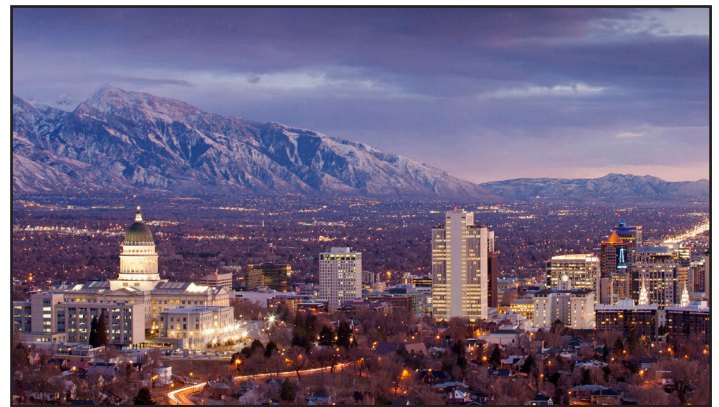


Photo by Adam Barker courtesy of visitsaltlake.com.

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CADRE 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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CADRE's Technical/Bibliographic Inquiry Service

CADRE 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 CADRE staff responds to nearly 400 inquiries per year, from over 150 customer organizations. For further information, please contact Nick Keim by email to nkeim@cadre.jhu.edu. Representative recent inquiries include:

TECHNICAL INQUIRIES

- Data on nitrile rubber property degradation for long-term storage at elevated temperatures with exposure to air (Req. 28232)
- Information on HPLC or IC methods for determination of amide content in 2-(5-Cyanotetrazolato)Pentammine Cobalt(III) Perchlorate (BNCP) (Req. 28117)
- Sensitivity, impact (ERL/BOE), friction (Joules), VTS, and shock data for lead azide, lead styphnate, and RDX (Req. 28096)

BIBLIOGRAPHIC INQUIRIES

- Collection of reports related to the Scaled Composites accident in July 2007 (Req. 28221)
- Performance tailoring of extruded double-base propellants. Topics included I_{sp} modification, mechanical properties, sensitivity, etc. (Req. 28089) and noncompositional effects on double-base propellant performance. (Req. 27981)
- Literature on self-ignition or detonation of LOX-RP pools (Req. 28135)

CADRE Subscriptions

CADRE forwarded GFY 2016 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 a CADRE subscription and/or products and services, please contact Hwei-Ru Chen at 410-992-7300, ext. 212 or email hchen@cadre.jhu.edu. You may also visit <https://www.cadre.jhu.edu/subscriptions>.

JANNAF Heads to Salt Lake City...*continued from page 1*

the destination for attendees and new friends to unwind and network over dinner.

When attending the JANNAF meeting, basic knowledge of current programs in the field will be expanded. But also expect to network with fellow professionals, including DoD/NASA program managers and decision-makers in the propulsion industry; pursue the development of new business opportunities; learn about future employment opportunities; and meet new people to add to your sphere of influence.

Dr. Louis Cannizzo, Director of Research and Development (R&D) for the Propulsion Systems Division of Orbital ATK, will present the keynote at this year's conference. The title of his address is "Crucial Elements in the Development of Energetic Materials for Propellant and Explosive Formulations." His presentation will illustrate major factors routinely encountered when introducing and scaling new ingredients and formulations from laboratory to production process environments.

In his current position at Orbital ATK, Cannizzo directs a staff of R&D scientists and engineers tasked with the development of strategic materials, formulations and technologies for the solid rocket industry. The Orbital ATK R&D group is also recognized worldwide for developing products and services in the motor health management, explosive, gun propellant, military flare and decoy, pyrotechnic, initiator and warhead industries. His organization is actively involved in troubleshooting material-based development and manufacturing issues within Orbital ATK and for many commercial and government customers.

Prior to his current position, Cannizzo has worked in a number of different roles at Orbital ATK and the heritage companies Morton Thiokol, Thiokol, and ATK during a 27-year career. Most recently he served as Chief Scientist for R&D before accepting his current position as Director in 2011.

Cannizzo started his career at Morton Thiokol in 1988 as a staff scientist synthesizing and characterizing new energetic materials including CL-20, GAP, energetic block co-polymers, and a number of furazan-based materials. He also participated in the development of new demilitarization technologies and served as an in-house consultant for addressing major chemistry-related manufacturing issues. He progressed through a series of roles as team leader, technical marketer, and senior staff scientist. He also was the Technical



Dr. Louis Cannizzo, Director of Research and Development at Orbital ATK, will discuss major factors encountered when introducing and scaling new ingredients and formulations from laboratory to production process environments during his keynote speech at the JANNAF meeting in Salt Lake City, UT.

Director for ATK at the Radford Army Ammunition Plant for twelve months on his one assignment outside of the Promontory, Utah location. He has co-authored seventeen US patents, approximately two dozen papers in refereed journals, and published a number of papers at government/industry conferences.

Cannizzo earned his Bachelor of Science in chemistry from the University of New Mexico and obtained his Ph. D. in Organic Chemistry from Caltech under the direction of Professor Robert Grubbs, a Nobel laureate. He spent one additional year in post-doctoral studies at Colorado State University before starting his industrial career.

The JANNAF meeting will be chaired by Mr. Paul F. Jones, Air Force Research Laboratory, Edwards AFB. The deadline for the early registration fee has been extended to Dec. 2. For additional information about the JANNAF meeting including new hotel information, please visit <https://www.jannaf.org/meetings>.

Programmatic Industrial Base to Hold Open Panelist Session, Specialist Session on Rocket Motor Issues, Future Weapons

At the JANNAF meeting in December of 2014 in Albuquerque, the new Programmatic Industrial Base (PIB) Subcommittee held its first ever panel session. Members of government and industry held dynamic discussions on a wide range of topics concerning the health of the rocket propulsion industrial base. The questions ranged from “How do we stay relevant to the new generation of scientists and engineers?” to “How can we become more efficient without sacrificing American jobs?”

The Programmatic and Industrial Base Subcommittee will be holding another panel discussion, as well as a specialist session, at the upcoming JANNAF meeting in Salt Lake City, UT.

During the months since the PIB last convened a panel, CADRE staff have been providing significant support to the leaders of the Subcommittee through various means. The most significant of the accomplishments of

“How can we become more efficient without sacrificing American jobs?”

the last year is the commendable progress being made on a comprehensive report assessing the health of the industry as a whole. When completed, this report will cover each major sector of the industry, from large solid propulsion, to research and development. CADRE has been providing support through the provision of facilities, support staff, and technical staff assistance. This is an immensely important topic at this time of

reevaluation in the rocket propulsion economy, and CADRE is pleased to play an integral role in the further development of the PIB.

At the upcoming JANNAF meeting in Salt Lake City, Utah, there will be two PIB events which will be open to

“What are the real threats/impediments to meeting performance goals for future weapon systems?”

all attendees. The first of these will be a panel discussion entitled “Impediments to Meeting Goals for Future Weapons,” chaired by John McGinn of the Office of the Secretary of Defense (OSD). Participants will include representatives from Orbital ATK, Aerojet Rocketdyne, Raytheon, and Lockheed Martin. The panelists will attempt to address the following questions: “What are the real threats/impediments to meeting performance goals for future weapon systems?; How should the Government be involved, and how is your company addressing these threats?” The second PIB activity, a Specialist Session titled “Rocket Motor Industrial Base Issues,” will be chaired by Christine Michienzi, also of OSD. The specialists participating in this session will offer answers to the eternal question: “What keeps program offices up at night?” Representatives from various Program Offices will give short presentations on salient issues they are facing as a result of recent Department of Defense and NASA budget declines. The presentations will be followed by a question and answer session.

JANNAF hosts 3rd Session on Homemade Explosives in SLC

JANNAF will be hosting its third Specialist Session on the topic of Homemade Explosives at the meeting. The session, *New Developments and Safety in HME Research*, will feature discussions by members of academia, industry, and government, including Dr. Kirk Yeager, the FBI’s senior explosives scientist. During this session, new research in the safe handling, testing, and detection of IE/HME will be presented by explosives experts conducting research to counter terrorist efforts and protect the nation from IE/HME attacks.



Dr. Kirk Yeager, FBI, to present at JANNAF.

Blast and Fragmentation Training to be Offered in December

As part of its continued support of professional development for the rocket propulsion community, JANNAF will host the White Sands Test Facility Blast and Fragmentation Training Course for a limited number of attendees at the December JANNAF Meeting. The training is designed to provide a combination of self-study and guided instruction of theory in basic blast and fragmentation analysis as well as providing a baseline understanding of the techniques used to analyze explosive systems. There is an emphasis on established methods used by the military and government as well content to ensure attendees understand the required standards that must be followed in order to ensure safe operations of large scale propulsion systems. The training will benefit any individual or organization dealing with or handling highly energetic systems. It is not solely limited to those handling explosives; it is applicable to anyone using cryogenics or high pressure gaseous systems.

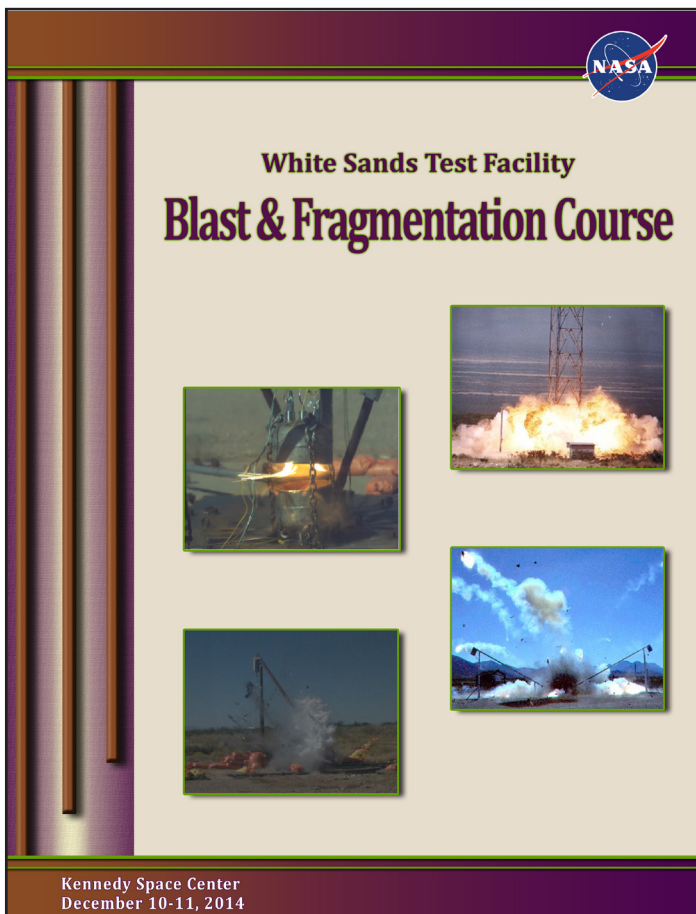
WSTF has developed this training over a number of years with the first beta course conducted in late summer of 2015. Lead Instructor Tommy Yoder's background is in the test and evaluation of composite overwrapped

pressure vessels (COPV), with experience as the shuttle auxiliary power system fleet-leader program, and management of multiple commercial and government COPV programs. Instructor Chris Keddy's background is in high energy system evaluation including high explosives, propellants, hypervelocity impacts, pneumatic, cryogenic, and hydraulic systems with a special focus in analytical and numerical modeling. Both instructors are involved in the test and evaluation of components for which failure is assumed and generally desired, requiring blast and fragmentation calculations to be performed to ensure adequate protection of personnel, facility, and the environment. Together these instructors have more than 40 years of combined experience at WSTF in their respective fields of expertise.

The majority of the training is instructor-led in a traditional lecture format, with anecdotes and real world experiences that the instructors have gained from past decades of performing analysis and modeling of explosive systems with an emphasis on established methods used by the military and government. There are a number of check-on-learning exercises that appear in the course material to aid in reinforcing key points of the training.

Benefits of Training

- *Basic understanding of blast waves and differences between types of explosions.*
- *Basic set of tools and references to attempt simple blast analysis based on the principles of overpressure, impulse, fragmentation, structural response, and a brief introduction to the concept of Quantity-Distance.*
- *Working understanding of the limits of structures and the human body to resist or survive blast waves.*
- *Understanding of the current state-of-the-art techniques available and the limitations of analysis of blast generating systems and associated fragmentation.*
- *A base knowledge of the governing standards and rules that pertain to the military, government, and private sector handling of energetic systems.*



Collaborative Sensors Database Developed as Product of JANNAF Panel Meeting through Partnership with DoE

In collaboration with the Joint-Army-Navy-NASA-Air Force (JANNAF) Integrated Health Management and Engine Health Management Panels, as well as the Department of Energy National Energy Technology Laboratory (DoE NETL), a database was developed to collect information on sensors and applications of those sensors to propulsion and energetic systems. Funded by the Air Force Research Laboratory (AFRL), NASA, and the DoE, the database is designed to allow collaborative data input by the community with oversight and review of the data provided by JANNAF.

There has historically been a lack of communication between and within projects in the aerospace industry, which are often compartmentalized for security or proprietary purposes. This often leads to duplication of effort and difficulties informing the commercial base of needs and gaps in technology. JANNAF has long been a source for collaboration between the government agencies, industry, and academia, and thus, is perfectly positioned to facilitate and develop shared databases. Several years ago in 2007, the JANNAF Interagency Propulsion Committee identified the need for a secure, communal sensor knowledgebase. To determine what form this would take, JANNAF held several workshops over the next few years, gathering input from industry, government agencies, and academia. At the JANNAF meeting in May 2010 in Colorado Springs, representatives of the DoE NETL, and members from the JANNAF Integrated Health Management (IHM) and Engine Health Management (EHM) panels agreed to develop a “Joint Sensors Database.” They identified several potential benefits to the knowledgebase, such as identifying available sensors and their successful implementations, identifying gaps in sensor technology, leveraging knowledge across different agencies, industry, and academia, cross pollination of sensors between the energy sector and the aerospace industry, and the ability to identify and update TRL for sensors in development. The 2010 meeting generated a specific list of goals for the database as well. They decided on an online database for information sensors with aerospace and energy applications. They also wanted a flexible database with collaborative data collection—user driven data collection, with search features and the ability to generate side by side comparisons. Finally,

the online database needed to be secure, with access restricted to United States government agencies and their contractors. The list of specifications that would become framework for what data was collected for a given sensor also grew out of discussions at the May 2010 meeting. The development and population of the Joint Sensors Database would continue off and on over the next few years, driven by CADRE.

As of the Spring 2015 JANNAF Interagency Propulsion Meeting in Nashville, the electronic framework for the Joint Sensors Database had been completed. Data collected includes physical and electrical properties of sensors, as well as manufacturer or developer information. Each sensor included in the database can have an unlimited number of application notes attached. These application notes describe specific uses of the sensor, the environment in which it is used, and the performance of the sensor in the specific application. Users of the database can search for sensors that meet their specific requirements and determine whether a sensor has been used in a similar application. The database itself is limited distribution and so descriptions of sensor applications can include U.S. Government critical technology, which is not publicly releasable. Access to the database is controlled by CADRE to ensure that all users meet the appropriate security requirements; if you have a JANNAF account, you have access.

CADRE has made significant outreach efforts in the year through telecoms and conferences such as the DoE Crosscutting Research Review, Future of Instrumentation and Internet Workshop, the June 2015 JANNAF meeting, and the CRAFT and NSMMS conferences. Through these efforts, the DoE has pledged to provide support by committing data for all of their currently funded sensor development projects. Scott Hyde of Orbital ATK has also generously provided data on sensors being used currently on the IMLM DAAS program. These represent the connections and effort necessary to grow the database. CADRE has so far done the majority of the data entry and collection, and it is clear that for further growth of the database, involvement of JANNAF entities, the DoE, and industry is needed.

If you would like to get involved, please email: bhillelam@cadre.jhu.edu.

CADRE Supports JANNAF with Thermal Stability of Fuels

The conditions at which a fuel begins to decompose under pyrolysis can significantly impact or even jeopardize the performance of regeneratively cooled liquid rocket engines. These engines rely on fuel-cooled passages to keep critical components of the engine at sustainable temperatures, specifically the combustion chamber and throat. The current MILSPEC for Rocket Propellant (RP)-2 fuel includes the JFTOT (Jet Fuel Thermal Oxidation Test) as a placeholder until a more suitable fit-for-purpose test method can

provided seed funding for JHU CADRE to design and build the first generation Compact Rapid Assessment of Fuel Thermal Integrity (CRAFTI) apparatus. With funding from DLA-Energy and in collaboration with AFRL-RQRC and the University of Washington (UW) the CRAFTI apparatus has been used to test more than twenty different blends of RP fuels and has shown promising results in terms of repeatability and the ability to distinguish between thermal stability of tested fuels. Subsequent testing will seek to establish a Thermal Integrity Index (TII) that can effectively be used to rate and rank the thermal stability performance of hydrocarbon rocket fuels.



Nick Keim, AERo Fuels Lab Manager, makes an adjustment to the CRAFTI apparatus.

be included in the RP specification. With increasing interest in designing next generation kerosene-fueled liquid rocket engines the impetus for establishing such a replacement test is growing. A truly stressful test method that is capable of distinguishing between different levels of thermal stability will allow engine designers to push the envelope in terms of thrust chamber wall temperatures, bulk fuel temperatures, and heat fluxes in their designs.

At the 2011 JANNAF Liquid Propulsion Subcommittee meeting in Huntsville, Ala., the Hydrocarbon Fuels Panel found wide community support for such a test. As a result, the U.S. Air Force

The CRAFTI apparatus was designed by CADRE technical staff and is operated at CADRE's Advanced Engine & Rocket (AERo) Fuels Laboratory in Baltimore, Md. CRAFTI represents the first step towards a comprehensive fuel thermal stability specification test. The test procedure allows for multiple (up to three) runs of fuel per day and uses approximately two gallons per test, making it capable of testing small test batches of fuel. Compared to the JFTOT and the High Reynolds Number Thermal Stability

tester (HiReTS), the CRAFTI apparatus has been designed to produce environments that are similar to a regenerative cooling rocket engine: high pressures, copper channels, high heat flux and moderate-high wall temperatures. This capability allows for the AERo Fuels Lab to analyze the effect of wall temperature, pressure, heat flux, and flow rates on the pyrolytic decomposition of the fuel. Test articles from CRAFTI are analyzed using a LECO RC612 Multiphase Carbon Analyzer with a test method developed by the lab, capable of distinguishing between types of carbonaceous deposit produced during the test.

A second CRAFTI is planned to be constructed at AFRL to enable round-robin testing between CADRE

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Thermal Stability...*continued from page 7*

and AFRL-RQRC to verify the repeatability and reproducibility of the experiment and associated procedures and methods. The progress made since 2011 has gone a long way to closing one of the long-standing issues associated with specifying high performance hydrocarbon fuels for liquid rocket engines. The JANNAF LPS Hydrocarbon Fuels Panel is actively involved in the oversight of this work and is collaborating with the APS Airbreathing Fuels Panel to ensure that the endothermic hydrocarbon fuels community is able to benefit from this research.

The CRAFTI apparatus and subsequent testing have been a direct result of needs identified by the JANNAF community and its subcommittees and panels. The team at CADRE and the AERo Fuels Laboratory are pleased to be able to contribute to JANNAF and the propulsion community.



The CRAFTI apparatus was designed by CADRE to test the thermal stability of rocket fuels such as RP-1, pictured.

Additive Manufacturing Remains Hot Topic for Propulsion Applications

The Joint Army-Navy-NASA-Air Force (JANNAF) Liquid Propulsion Subcommittee (LPS) Advanced Materials Panel hosted an Additive Manufacturing for Propulsion Applications Technical Interchange Meeting (TIM) on Wednesday-Friday, September 3-5, 2014, in Huntsville, Alabama at the Jackson Center. NASA and the Department of Defense have committed significant effort towards development of 3D Printing, Rapid Prototyping, and Additive Manufacturing technologies to accelerate testing of new propulsion designs, and ultimately qualifying them for use in flight applications. This TIM offered both the government and industry an opportunity to share the results of these efforts, to encourage organizations with similar interests, and provide insight into the plans for future developments.

The Liquid Propulsion Subcommittee (LPS) addresses technical problems and issues of greatest national need associated with liquid propulsion systems, and the Advanced Material Panel has been involved in numerous advances in the development and acceptance of new materials for the propulsion community. Between the 3D printer being sent to the International Space Station, to the public statements of different launch vehicle manufacturers about the application of Additive Manufactured parts on the engine and other systems, hardly a week goes by without some news item proclaiming the application of Additive Manufacturing in this area. While the panel normally operates in conjunction with the annual LPS meetings, the topic of additive manufacturing is such a key item in the media these days that a focused, stand-alone meeting was warranted, with the government, academia and industry members of the Advanced Materials Panel bringing together the different communities; and discussing from a technology development and material science perspective what is known and what is still unknown about additive manufacturing, specifically focused on propulsion applications.

Organized as a single track, the TIM with financial support from the JANNAF executive Committee, the response far exceeded the planning team's expectations.

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JANNAF and NIRPS Hosted Technical Interchange Meeting to Develop Roadmap for Green Monopropellant Alternatives to Hydrazine

The JANNAF Interagency Propulsion Committee and the National Institute for Rocket Propulsion Systems (NIRPS) hosted a Green Monopropellant Alternatives to Hydrazine Technical Interchange Meeting (TIM) on August 4-5, 2015 at the Jackson Center in Huntsville, Ala. After seeing the Green Propellant Roadmap at NASA Marshall Space Flight Center (MSFC), Dr. Michael Gazarik, the former Associate Administrator for Space Technology Mission Directorate at NASA requested an agency-level discussion to build an agency-level roadmap on green propellants.

The TIM Planning Committee, which consisted of members from MSFC, Glenn Research Center (GRC), Goddard Space Flight Center (GSFC), Air Force Research Laboratory (AFRL), and Defense Logistics Agency (DLA), accepted 37 out of 55 abstracts for presentations over the course of two days. A total of 35 presentations were made.

There were more than 120 attendees representing five

universities; seven DoD organizations; eight NASA organizations; and 29 companies. The third day of meetings were held onsite at MSFC for a government only caucus to discuss development of a NASA roadmap that takes into account leverage of DoD green propellant investments. The government group will continue to meet remotely every two weeks until November 2015 to provide input to the agency roadmap and funding recommendations.

The following topic areas were discussed during presentations: ground operations, productions and storage of hydrazine; enabling spacecraft missions with the use of green propellants; commercial spacecraft primes input on advantages and disadvantages of new propellant entrants; long term storage, handling and transport of green propellants; international participation; ignition techniques; stability and performance; materials durability and compatibility; and component fabrication and test.

Additive Manufacturing ... *continued from page 8*

With total registrations of 281, and peak attendance throughout the three-day meeting at 230, the activity level during the week was constantly high. Even before the registration started, the response to the Call For Presentations exceeded the available presentation slots. A total of 33 author teams were selected for presentations across nine topic areas, and an additional nine author teams were invited to bring posters of their work for display throughout the week. Kicking off the event for the early arrivers was a tour of the NASA Marshall Space Flight Center areas with special interest in additive manufacturing. This helped orient many of the presentations later in the meeting.

Sessions were organized around nine topics, starting with the development and investment strategies of the various government agencies and Public/ Private Partnerships. Following these Strategy presentations, specific technical areas were: Post-Build Processing; Finishing and Inspection; Additive Manufacturing

Techniques and Machines; Materials; Component Fabrication and Test; Design for Additive Manufacturing; Process Qualifications and Specifications; Economic Considerations for Return on Investment and Schedule; and Process Analysis, Sensing and Control, and Non-Destructive Evaluation.

At the end of the week, the meeting culminated in a panel discussion with select members of academia, industry and the government technology development organizations fielding questions from the audience on the future needs of this area.

As the attendees headed off to their respective organizations, there was a keen sense that we have only scratched the surface of this new technique, and while the promises of revolutionary manufacturing capabilities abound, the risks of individual and systemic failures do as well. The Advance Materials Panel intends to keep the dialog started in this TIM open and flowing.

At Your Service: CADRE's Technical Resources and Expertise for All Your Research Needs

After a recent name change, CADRE will continue nearly 70 years of CPIAC's legacy with improvements to its services. A new secure portal includes access to the Small Team Collaboration space, subscription packages and a Chemical Propulsion Information Network (CPIN) Suite of Databases for purchase, to individuals and organizations within the commercial propulsion industry. U.S. After a recent name change, CADRE will continue nearly 70 years of CPIAC's legacy with improvements to its services. A new secure portal includes access to the Small Team Collaboration space, subscription packages and a Chemical Propulsion Information Network (CPIN) Suite of Databases for purchase, to individuals and organizations within the commercial propulsion industry. U.S. Government employees with portal accounts already receive these services and resources free of charge.

This suite includes the new JANNAF Digital Online Collection (JDOC), with complete access to more than

23,000 papers, reports, standards and manuals in a downloadable PDF format.

A one-year CADRE subscription includes six hours of CADRE's Technical and Bibliographic Inquiry (TBI) research service, access to the CPIN Suite of JANNAF Databases and a complimentary copy of the "JANNAF Journal of Propulsion and Energetics." The total cost for a subscription is \$1,775.

Experienced CADRE technical staff can leverage their vast scientific and technical knowledge, internal and external databases, and subject matter expertise network to answer all your research and development needs no matter how big or small your inquiry. For more information or to place an inquiry, please contact CADRE's technical inquiry line at 410-992-7301.

All JANNAF meeting attendees will have access to the JDOC database for a one-year period.

Unlimited access to the CPIN Suite of Databases is also available for anyone within a given organization for the cost of \$8,750. Academic organizations and small businesses should call CADRE for available discounts.

63rd JPM / PIB / 47th CS / 35th APS / 35th EPSS / 29th PSHS to Meet

**Date: May 16 – 20, 2016
Newport News, Virginia**

Plans are underway for the May 2016 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF), which will consist of the 63rd JANNAF Propulsion meeting (JPM); the Programmatic and Industrial Base meeting (PIB); and the Joint Meeting of the 47th Combustion (CS) / 35th Airbreathing Propulsion (APS) / 35th Exhaust Plume and Signatures (EPSS) / 29th Propulsion Systems Hazards (PSHS) Subcommittees, to be held Monday through Friday, May 16 - 20, 2016. The location will be Newport News, Virginia.

Call for Papers

The Call for Papers has been released; abstracts are due December 7, 2015.

More Information

Program and keynote information will be available in late February. Please visit <https://www.jannaf.org/mtgs/May2016/pages/index.html> for updates. A preview of the meeting will be featured in the Spring 2016 issue of *JANNAF News*.

Questions

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

- JPM – Peter Zeender (pzeender@cadre.jhu.edu / 443-718-5001)
- PIB – Kirk Sharp (ksharp@cadre.jhu.edu / 228-234-5423)
- CS, APS – Bryan DeHoff (bryan.dehoff@aerospacetechnic.com / 513-378-7071)
- EPSS – Nicholas Keim (nkeim@cadre.jhu.edu / 443-718-5005)
- PSHS – Andrew Taylor (ataylor@cadre.jhu.edu / 410-992-7306)

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

The 62nd JANNAF Propulsion and Programmatic and Industrial Base, 10th Modeling and Simulation, 8th Liquid Propulsion, and 7th Spacecraft Propulsion Joint Subcommittee Meeting

A Message from the Chair, Dr. Richard K. Cohn

I would like to thank everyone who participated in the 62nd JANNAF Propulsion Meeting and the 10th Modeling and Simulation, 8th Liquid Propulsion, 7th Spacecraft Propulsion Joint Subcommittee Meeting. The meeting was a full four days of talks in many diverse areas. I will gladly accept the main complaint that “there were too many interesting papers and I couldn’t make all of the talks that I wanted.” I think this shows the high quality of the information presented at the meeting. I was particularly pleased with the success of the plenary session held within the Modeling and Simulation Subcommittee. I hope that the subcommittees can continue to hold their own plenary sessions to supplement the keynote address. This meeting could never have happened without the support of CADRE. They were truly indispensable to the process and went above and beyond to ensure that every paper was cleared and loaded onto the computer system for presentation – even when they were not received until shortly before the talk was to be given. I am truly honored to have been given the opportunity to chair this meeting.



Dr. Richard K. Cohn, Air Force Research Laboratory, chaired the June JANNAF meeting in Nashville, TN

Keynote address discusses challenges to the space launch industry

The Keynote address at the JANNAF meeting was delivered by Matthew Smith, of United Launch Alliance (ULA). Smith’s address was titled *The Economics of Innovation*. Smith discussed the factors leading to the original selection of the RD180 for the Atlas V EELV program in the 1980s, its pending replacement by the Blue Origin BE4 engine, and the challenges associated with the introduction of new innovations in space launch systems.

Smith is Vice President of Engineering for ULA, which is headquartered in Centennial, Colo. In this role, Smith has enterprise-wide responsibility for engineering personnel, processes, tools, products and services as well as technical oversight and launch readiness certification activities. He also leads the knowledge management and technical workforce development activities at ULA. This includes business support of the college intern program, which builds and launches large-scale model rockets each summer with payloads from the Ball Aerospace intern program and local area high school teams.

Prior to joining ULA, Smith served as technical director and chief engineer for Atlas programs at Lockheed Martin Space Systems Company. Previously, Smith served as chief engineer for Atlas V/Evolved Expendable Launch Vehicle (EELV) development, chief engineer for Atlas IIAS launch pad development at Space Launch Complex 3 at Vandenberg Air Force Base in California, and director of Atlas propulsion systems.



Matthew Smith, Vice President of Engineering at ULA, delivered the keynote address at JANNAF in June.

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Smith began his career with the Atlas Launch Vehicle program in 1983 as a pneumatics system design engineer for the Convair division of General Dynamics. Following this assignment, Smith assumed a number of increasingly responsible positions on the Atlas program including propulsion and fluid systems lead for Atlas I and II development and recurring programs chief engineer.

Smith earned his Bachelor of Science in applied mechanics and engineering science from the University

of California-San Diego.

Smith functions in a number of education related roles including serving on the boards of directors for the Colorado Legacy Foundation, STEM High and STEM Academy, a charter school organization. He is also chair of the Colorado State Council on Educator Effectiveness, which provides recommendations to the State Board of Education about how to evaluate the effectiveness of the state's teachers and principals.

JANNAF Online Digital Collection Now Available

CADRE is pleased to announce the launch of a new online catalog of JANNAF papers and publications. The JANNAF Digital Online Collection (J-DOC) is now available to all U.S. Government civil servants with JANNAF Portal accounts and to attendees of JANNAF Joint Subcommittee Meetings. Access to J-DOC is granted for one year at a time, and will replace the distribution of unclassified JANNAF meeting proceedings. Through J-DOC, users are now able to directly download PDF versions of documents from within the catalog – giving users immediate access to almost every unclassified JANNAF and CPIA paper, publication, and standard from as far back as 1958.

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For more information about accessing J-DOC please contact Tricia Reider at 410-992-7300.

In Memoriam



U.S. Veteran **Lewis Peach, Jr.**, 71, passed away on November 22, 2014 at his home in Arnold, Md. He retired from Senior Executive Service at NASA where he served as Project Manager in the Office of Space Flight, and the NASA Academy for Program/Project and Engineering Leadership. He was a vice-president for exploration/development at Universities Space Research Association. Lewis began his career at NASA's Ames Research Center. He was a board member of Hawaii's Pisces space program and was a Vietnam veteran. He was born in Norfolk, Virginia where he married his wife of 40 years, Denise. Peach is survived by four children - Lewis Peach, III, Heather Peach, John Peach and Crystal Burr. He had three grandchildren.

Modified from Barranco & Sons, P.A. Severna Park Funeral Home

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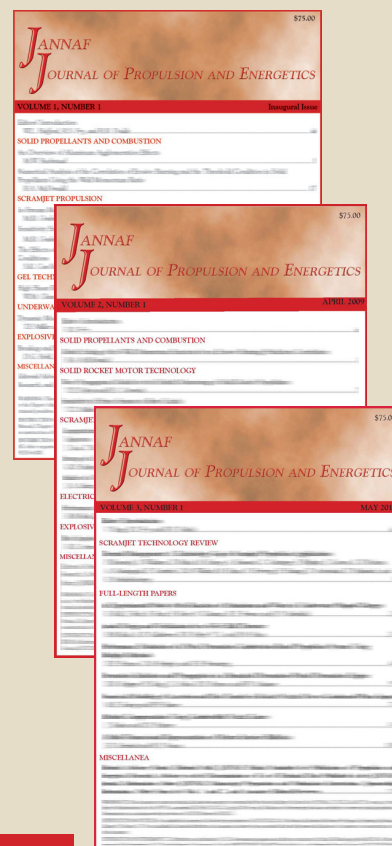
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Calendar of JANNAF Meetings

63rd JPM / PIB / 47th CS / 35th APS / 35th Exhaust Plume Signatures / 29th Propulsion Systems Hazards Joint Subcommittee Meeting: May 16-20, 2016

Newport News, Virginia

Deadlines:

Dec 7	Deadline to submit JPM abstracts
Mar 14	Deadline for award nominations
Mar 14	Deadline to submit student paper award nominations (papers due)
Apr 4	Deadline for changes to final program
Apr 18	Papers and paper clearance forms due to CADRE
April 22	Deadline for hotel reservations
May 2	Registration forms due. Last day for discounted registration fee. Presentation due to CADRE.

For additional information and registration, please visit:

<https://www.jannaf.org/mtgs/May2016/pages/index.html>

For additional information on the above JANNAF meetings, contact CADRE at 410-992-7302.

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Registration for JANNAF meetings is a **two-part process**; to complete this process:

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- Once you have an approved JANNAF Secure Portal, then you can complete the brief Registration Questionnaire.

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