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JANNAF NEWS

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INTERAGENCY PROPULSION COMMITTEE

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Huntsville to Host December 2022 JANNAF Meeting

JANNAF makes its way back to Rocket City for the December 2022 JANNAF Meeting from Dec. 5-9, 2022. The featured keynote speaker at the meeting is Joel B. Mozer, Ph.D., Director of Science, Technology, and Research for the U.S. Space Force at the Pentagon in Arlington, Virginia. The meeting will be held at the Huntsville Marriott at the Space and Rocket Center in Huntsville, Alabama, and will feature a joint gathering of the 13th Liquid Propulsion Subcommittee (LPS) and 12th Spacecraft Propulsion Subcommittee (SPS), as well as a meeting of the Programmatic and Industrial Base (PIB). The Huntsville meeting will be chaired by Matthew C. Billingsley, with the Air Force Research Laboratory at Edwards AFB, California.

Dr. Mozer's keynote speech will be held on Tuesday, Dec. 6. The speech, titled "The Space Force After Next, and How We Survive to Get There," will address procedures used to aid in determining future priorities and investments for the U.S. Space Force. The role of the United States Space Force is to organize, train, and equip forces to support operations and warfighters who, today, are largely on the ground, in the air, or at sea.

Matthew C. Billingsley, Air Force Research Laboratory, Edwards AFB, California, will chair the JANNAF Meeting.

Guardians also have the responsibility to deter warfare from extending into space and to protect and defend U.S. interests if it ever does. How do we prepare for that future when space is both a supporting and a supported domain? What science and technology do we need to invest in today to be ready for the Space Force After Next of 2040 and beyond, when space is expected to be

(See December 2022 JANNAF Meeting on page 3)

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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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ERG is the technical support contractor for the JANNAF Interagency Propulsion Committee operated by the Johns Hopkins University Whiting School of Engineering under contract FA9300-19-C-0002.

Recent ERG Publications

- Abstract Number: 2021-0023
  Guidelines for Uncertainty Quantification Analysis - MSS
  Nov 2021

- Abstract Number: 2021-0002
  Meeting Proceedings of the 47th Structures and Mechanical Behavior (SMBS), 43rd Propellant and Explosives Development and Characterization (PEDCS), 34th Rocket Nozzle Technology (RNTS), and 32nd Safety and Environmental Protection Joint Subcommittee Meeting / Programmatic and Industrial Base Meeting (PIB)
  Mar 2021

- Abstract Number: 2021-0024
  NASA Hypersonics Technology Project Research and Development on Carbon/Carbon-6 (ACC-6) Compilation of JANNAF Conference Papers (2016-2020)
  Nov 2021

- Abstract Number: 1980-0930
  Solid Propellant Mechanical Behavior Manual [Supersedes CPIAC Pub 21]
  Jan 2022

- Abstract Number: 2021-0004
  JANNAF Journal of Propulsion and Energetics, Volume 12
  May 2022

- Abstract Number: 2022-0002
  Meeting Proceedings of the 69th JANNAF Propulsion Meeting (JPM) / Programmatic and Industrial Base (PIB) / 51st Combustion (CS), 39th Airbreathing Propulsion (APS), 39th Exhaust Plume and Signatures (EPSS), 33rd Energetic Systems Hazards (ESHS), and 16th Modeling and Simulation (MSS) Joint Subcommittee Meeting
  Nov 2022

- All meeting proceedings are available in the JANNAF Digital Online Collection (JDOC) database, accessible through the JANNAF website (https//www.jannaf.org/).

ERG Subscriptions

We would like to take this opportunity to inform the community that a minimum yearly subscription of $1,850 entitles subscribers to one complimentary suite of JANNAF databases; complimentary access to the JANNAF Journal through JDOC; and six hours (prepaid) of technical/bibliographic inquiry hours. For information concerning a yearly ERG subscription and/or products and services, please contact Mionna Sharp at 410-992-7300, ext. 224, or email msharp@erg.jhu.edu. You may also visit https://www.erg.jhu.edu/subscriptions.

December 2022 JANNAF Meeting... *continued from page 1*

a much larger domain of human endeavor? Dr. Mozer will discuss how we scope this problem and how we accomplish the horizon scanning and strategic foresight work to inform the prioritization of science and technology today.

Dr. Mozer has more than 30 years of space science, engineering, management, and financial experience working space and ground systems for the DoD. Previous roles with AFRL include Chief Space Experimentalist of the Air Force Research Laboratory Space Vehicle Directorate at Kirtland Air Force Base in New Mexico, Chief of the Battlespace Environment Division, leader of the laboratory's Space Weather Center of Excellence, and scientist at the National Solar Observatory at Sacramento Peak. Before arriving at AFRL, Dr. Mozer worked at the Air Force's Radar Attenuation and Scattering facility at Holloman AFB, New Mexico, and the Army's Atmospheric Sciences Laboratory. In his current role as the Director of Science, Technology and Research for the U.S. Space Force at the Pentagon in Arlington, Virginia, Dr. Mozer is the central lead for all science and technology matters for an organization with approximately 11,000 space professionals worldwide, and manages a global network of satellite command and control, communications, missile warning and launch facilities. He develops long-term military requirements for the Space Force and interacts with other principals, operational commanders, combatant commands, acquisition, and international communities to address cross-organization science and technical issues and solutions. Dr. Mozer represents U.S. Space Force science and technology on decisions, high-level planning, and policy, building coalitions and alliances throughout the U.S. government, industry, academia, the international community, and other scientific and technology organizations.

Dr. Joel B. Mozer, Director of Science, Technology, and Research for the U.S. Space Force, the Pentagon, will be the keynote speaker at the December 2022 JANNAF Meeting.

For complete details on all the papers and topics at the December 2022 JANNAF Meeting, please see the meeting program, which is available through the JANNAF portal at https://www.jannaf.org/mtgs/2022Dec/pages/index.html.

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 Nicholas Keim by email at nkeim@erg.jhu.edu.

December 2022 Meeting Program Highlights

LPS

The JANNAF 13th Liquid Propulsion Subcommittee (LPS) will host a robust program of 14 technical sessions. LPS will also host the "Introduction to Additive Manufacturing for Propulsion Systems" training course. This course will provide an overview of the various steps in AM process trades, design, build process, post-processing, certification, and infusion of AM.

LPS will also conduct the LPS Combustion Stability Panel, which will announce and discuss the release of the JANNAF-GL-2022-0001 "Guidelines for Combustion Stability Specifications and Verification Procedures for Liquid Propellant Rocket Engines." This body of work supersedes CPIA Pub 655.

SPS

The JANNAF 12th Spacecraft Propulsion Subcommittee (SPS) will be hosting workshops on Electrical Propulsion Operation in the Space Environment and Facility Interactions. In addition, SPS will conduct a series of technical sessions on Hall Thruster Research and Development, and Cube/Micro Satellite Propulsion.

PIB

The JANNAF Programmatic and Industrial Base (PIB) will present a specialist session on Space Access, Mobility, and Logistics.

Plenaries

The December JANNAF Meeting agenda will include two plenary presentations.

The first plenary presentation, "PANEL DISCUSSION: Testing Capabilities and Needs for Fission Space Nuclear Systems," will feature Panel Chair Robert O'Brien, of Idaho National Laboratory in Idaho Falls, Idaho. Panelists will include representatives from Oak Ridge National Laboratory, NASA Marshall Space Flight Center, NASA Glenn Research Center, Analytical Mechanics Associates, and Nevada National Security Site. The panelists will discuss the means of acquiring data to support fission space nuclear efforts at the various levels of hardware development and integration, including a review of existing national capabilities already available for this purpose, gaps in these capabilities, and potential plans to fill some of those gaps and increase the capabilities of the nation to develop these types of systems.

The second plenary presentation, "Tactically Responsive Space (TacRS) Launch Solutions – More than Just Launching Faster," will be presented by Jordan M. Way, of the U.S. Space Force at Kirtland AFB, New Mexico. The presentation will address the tremendous implications that the growing consensus on the importance of TacRS has for how the Space Force and other agencies accomplish launch. The Space Force is proving out new launch-related technologies and processes, which will have an impact beyond TacRS missions. With its industry partners, the Space Force is exploring interesting possibilities to broaden how it delivers space capabilities.

All attendees are invited to participate in both plenary presentations.

***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 Gabrielle Delisle-Ballard at GDelisle@erg.jhu.edu.**

Thoughts from the JANNAF TEC / PEC

This space provides the JANNAF Technical Executive Committee (TEC) and the Programmatic and Industrial Base Executive Committee (PEC) with the opportunity to relay insights, awareness, and general communication to the JANNAF Community.

JANNAF Members and Friends,

As our communities emerge more fully from the COVID pandemic, we see a noticeable increase in JANNAF Conference participation and enthusiasm! The June 2022 JANNAF Conference brought 625 community members together in Newport News and Hampton, Virginia – marking record attendance numbers not seen in over 15 years. It is so wonderful to experience the productive networking and technical engagement of the Subcommittees, Panels, and Working Groups on both the Technical and Programmatic and Industrial Base sides. We live in an incredible time of weapons and spacecraft development, to include commercial space activity. You, as a member of JANNAF, can apply your knowledge and energies to helping further National Security, and this Nation's Space faring supremacy by continuing to share your technical papers and presentations in this ITAR protected forum. We also want to encourage our senior leaders and managers to help grow the next generation of subject matter experts by sponsoring the attendance of younger staff to attend and participate in JANNAF. Your commitment to our program has been strong for over 40 years and we encourage your leadership to invest in the people that will take us into the next 40 years!

- JANNAF TEC and PEC

ERG Offers Inquiry and Secure Virtual Team Services

We would like to remind you of the technical and bibliographic inquiry service that ERG provides, which is available to you for research using the JANNAF, DTIC, NASA, and academic resources available to Johns Hopkins University and ERG. If you need help looking up something, or if you are starting a new project as you transition your work back to the office, the technical staff at JHU-ERG are here to help. Email Nick Keim at nkeim@erg.jhu.edu and one of our technical staff will be in touch to see how we can assist you.

In addition to technical research services, ERG also provides secure virtual space through the JANNAF Portal. We can create secure teams on the JANNAF Portal to allow the exchange of ITAR, SBU, and limited-distribution unclassified files of all types (documents, data, etc.) to any subset of individuals who have portal accounts. Access is controlled by team leaders who are identified by the requesting entity. If you require assistance, or would like to try out the JANNAF Portal to enable remote collaboration, please contact Bruce Dennett at bdennett@erg.jhu.edu.

All products and services are free for U.S. Government employees to use and have already been paid for by your government organizations. They are also available to nongovernment organizations for a nominal cost—see page 2 for subscription information or visit our Subscriptions page. Please also visit our website to view the many databases we offer at www.jannaf.org and follow the three simple steps below to access them:

- Log into your portal account (upper right corner of the homepage)
- Click on "CPIN Access" under Resources on the right-hand side of the page
- Click on the database of your choice.

For more information, or to place an inquiry, please contact the ERG Technical Inquiries line at 410-992-7301, info@erg.jhu.edu, or contact Nick Keim at nkeim@erg.jhu.edu.

JANNAF Returned to In-Person Meetings in June

The first in-person JANNAF meeting since December 2019 was held June 6-10, 2022. Members of the JANNAF community convened in Newport News, Virginia, for the 69th JANNAF Propulsion Meeting, Programmatic Industrial Base meeting, as well as the following subcommittee occurrences for a Joint meeting: 51st Combustion, 39th Airbreathing Propulsion, 39th Exhaust Plume and Signatures, 33rd Energetic Systems Hazards, 16th Modeling and Simulation. The meeting also involved classified sessions hosted by NASA Langley Research Center in Hampton, Virginia.

Keynote speaker Venkateswaran Sankaran, Ph.D., Chief Scientist of the Aerospace Systems Directorate, AFRL, Wright-Patterson Air Force Base, Ohio.

Dr. David R. Gonzalez, Office of Naval Research, chaired the meeting. The keynote address was given by Dr. Venkateswaran Sankaran. Dr. Sankaran gave a presentation titled, "Science and Technology Opportunities in Digital Engineering of Aerospace Propulsion Systems."

As the Chief Scientist of the Aerospace Systems Directorate, Air Force Research Laboratory, Dr. Sankaran advises the director and guides the technical staff in the execution of the directorate's $500M science and technology portfolio in turbine engines, high-speed systems, power and controls, air vehicles, rocket propulsion, and modeling and simulations. He also provides expert technical consultation to Air Force organizations, the Department of Defense, other government agencies, universities, and industry. Dr. Sankaran obtained his Ph.D. from Penn State University in 1990 and worked as research

David Gonzalez, Ph.D., Office of Naval Research, Arlington, Virginia, was the Program Chair for the June 2022 Meeting.

faculty at Penn State, the University of Tennessee, and Purdue University from 1990-2006. Subsequently, he worked for the U.S. Army's Aeroflightdynamics Directorate at Ames Research Center from 2006-2011. Dr. Sankaran joined the Air Force Research Laboratory as a Senior Scientist for Rocket Propulsion in 2011.

Some of the highlights at this meeting included talks and sessions on the following topics: High Speed Test Facilities; Current and Future Space System Development; Hypersonic Propulsion Technologies; Kinetic Studies in Combustion; Computational Chemistry Prediction Methods; CFD Tools for Hypersonic Airbreathing Propulsion; Rotating Detonation Engines; Accelerating Signature Predictions; Computational Chemistry Prediction Methods; and Energetic Defect Characterization; among many other topics.

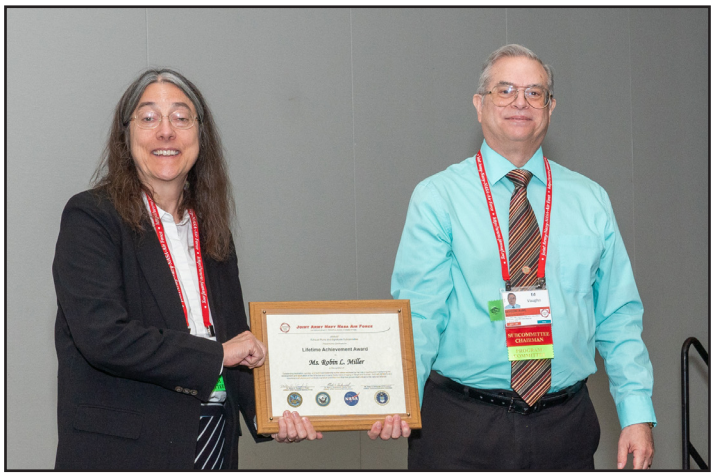
After two years of holding virtual meetings, JANNAF hosted a well-attended Networking Reception on June 8 at 6:30 p.m. for people to reconnect in person.

Robert Mercier, AFRL, Wright-Patterson Air Force Base, Ohio, discusses the JANNAF Journal of Propulsion and Energetics.

Michael Nusca, Ph.D., DEVCOM Army Research Laboratory, Aberdeen Proving Ground, Maryland, recalls his time as Combustion Subcommittee (CS) Technical Steering Group Chair from 2008-2014, as CS celebrated its 50th meeting, which was held virtually in December 2020.

PEC Co-Chair Christine Michienzi, Ph.D., Office of the Under Secretary of Defense (Acquisition & Sustainment) for Industrial Base Policy, District of Columbia, provides an update on the Programmatic and Industrial Base (PIB).

Mark Underwood, Ph.D., DEVCOM Aviation & Missile Center, Redstone Arsenal, Alabama, accepts an Exhaust Plume and Signatures Subcommittee (EPSS) Sustained Contribution Award from EPSS Technical Steering Group Chair Milton "Ed" Vaughn, Ph.D., DEVCOM Aviation & Missile Center, Redstone Arsenal, Alabama, on behalf of Kevin Kennedy, Ph.D., Gray Analytics, Incorporated, Huntsville, Alabama.



Ann Reagan, Ph.D., Naval Air Warfare Center Aircraft Division, Patuxent River, Maryland, accepts an Exhaust Plume and Signatures Subcommittee (EPSS) Lifetime Achievement Award from EPSS Technical Steering Group Chair Milton "Ed" Vaughn, Ph.D., DEVCOM Aviation & Missile Center, Redstone Arsenal, Alabama, on behalf of Robin Miller, Naval Air Warfare Center Weapons Division, Point Mugu, California.

Dean Eklund, Ph.D., Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio, accepts a Modeling and Simulation Subcommittee (MSS) Lifetime Achievement Award from MSS Technical Steering Group Chair Michael Watson, Ph.D., NASA Marshall Space Flight Center, Huntsville, Alabama.

JANNAF Propulsion Meeting (JPM) Program Committee Chair David Gonzalez, Ph.D., Office of Naval Research, Arlington, Virginia, recognizes Frank Tse, Naval Surface Warfare Center-Indian Head Division, Indian Head, Maryland, for the JPM Lifetime Achievement Award he received during the 68th JPM, held virtually in June 2021.

June JANNAF Meeting Award Recipients

JANNAF is pleased to announce the following awards presented at the June 2022 JANNAF Meeting.

Modeling and Simulation Subcommittee Best Technical Paper

Irvin Lee Davis, Ph.D.
Northrop Grumman Space Systems,
Brigham City, Utah

Modeling and Simulation Subcommittee Lifetime Achievement Award

Dean Eklund, Ph.D.
AFRL, Wright-Patterson Air Force Base, Ohio

For sustained service, contributions, and dedication to the JANNAF community over his career. His leadership has led to significant technical contributions to the JANNAF Modeling and Simulation Subcommittee and propulsion community in the advancement of simulation credibility, verification, validation, and uncertainty quantification.

Modeling and Simulation Subcommittee Lifetime Achievement Award

R. Scott Hyde
Northrop Grumman Corporation,
Brigham City, Utah

For lifetime achievement in the establishment, leadership, and sustainment of the Modeling and Simulation Subcommittee (MSS) Integrated Health Management (IHM) Panel.

Modeling and Simulation Subcommittee Sustained Contribution

Eric J. Paulson, Ph.D.
AFRL, Edwards Air Force Base, California

For sustained leadership and innovative support of the Modeling and Simulation Subcommittee as past TSG Chair and MBE Panel chair.

Exhaust Plume and Signatures Subcommittee Sustained Contribution Award

Kevin D. Kennedy, Ph.D.
Gray Analytics, Incorporated,
Huntsville, Alabama

In recognition of many years of outstanding dedication, service, and technical leadership as Chair of the JANNAF Exhaust Plume and Signatures Subcommittee. His efforts guided the development and communication of exhaust plume flowfield and signature prediction technologies that are instrumental to the national defense.

Exhaust Plume and Signatures Subcommittee Lifetime Achievement Award

Robin L. Miller
Naval Air Warfare Center Weapons Division,
Point Mugu, California

In recognition of outstanding dedication, service, and technical leadership to the nation rendered by her role in guiding and maintaining the development and application of the Spectral and In-band Radiometric Imaging of Target and Scenes - AirCraft (SPIRITS-AC) missile/aircraft plume and hardbody signature prediction tool that has proven itself critical to the national defense.

Combustion Subcommittee Sustained Contribution Award

Chiung-Chu Chen, Ph.D.
DEVCOM Army Research Laboratory, Aberdeen Proving Ground, Maryland

For achievement in reaction chemistry of rockets, gun-propellants and explosives. Dr. Chen postulated elementary reaction steps for decomposition of large molecules and developed methodologies that were both reliable and computationally tractable. She produced the first first-principles-based reaction networks capable of elucidating the interplay between competing decomposition pathways, providing guidance to propulsion system designers, energetic material formulators, and synthetic chemists.

Congratulations to all award recipients!

Changes to JANNAF Publication Processes

As you may have noticed, over the past few JANNAF meetings there have been a number of changes to the publication clearance form associated with publishing your work as part of the JANNAF proceedings. The biggest and potentially most confusing change has been the integration of Controlled Unclassified Information (CUI) requirements into the publication process. In the past, JANNAF papers and presentations were required to have DoD distribution statements – regardless of whether the work was funded by the DoD. With the implementation of CUI, it is no longer necessary to require DoD distribution statements – however, it does bring all of its own requirements associated with CUI category, dissemination limitation, controlling authority, and Point of Contact (POC).

In addition to the inclusion of CUI in the JANNAF publication clearance form, we are also now allowing authors to decide whether their presentation can be included in the proceedings along with the paper. Changes to JDOC are coming to allow both presentation and paper to be viewed in instances where authors have elected to have their presentation archived.

Outside of the publication clearance forms, the JANNAF Technical Executive Committee has determined that presentations on previously published technical work will be accepted. For example, if you have published a technical report to Defense Technical Information Center (DTIC) and would like to present on that work at JANNAF, you may now do so without having to write an additional paper for JANNAF. To do this, you should complete the regular abstract submission process for a regular JANNAF paper, but please note in your abstract that the paper will be a previously published report and provide the relevant citation. Papers are still required even if they have been previously published outside of JANNAF, so authors will still be required to submit the prior written work associated with the presentation so that it may be included in JDOC.

As you consider these changes to the JANNAF publication process, please be mindful that missing JANNAF deadlines has a real impact on the staff at ERG. We have a history of accommodating the community, and we try to ensure that everyone is able to present and have their material published; we ask that you do your part and meet the published deadlines for papers, presentations, and clearance forms.

70th JPM / PIB / 48th SMBS / 44th PEDCS / 33rd SEPS / 17th MSS / 1st HTMAS
May 22-26, 2023
Wyndham Grand Pittsburgh Downtown / Pittsburgh, Pennsylvania

Abstract Deadline: 9 December 2022

Meeting Website
https://www.jannaf.org/mtgs/2023May/pages/index.html

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

- JPM – Michael "Miki" Fedun (mfedun@erg.jhu.edu / 540-273-5501)
- PIB – Kirk Sharp (ksharp@erg.jhu.edu / 228-234-5423)
- SMBS – Claire Shamul (cshamul@erg.jhu.edu / 443-718-5011)
- PEDCS – William Bagley (wbagley@erg.jhu.edu / 443-718-5009)
- SEPS – William Bagley (wbagley@erg.jhu.edu / 443-718-5009)
- MSS – Michael "Miki" Fedun (mfedun@erg.jhu.edu / 540-273-5501)
- HTMAS – Claire Shamul (cshamul@erg.jhu.edu / 443-718-5011)

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

June 2022 JANNAF MSS Hosted UCAH Session:
Planning, Execution, and the Path Ahead

Back in September 2021, the Energetics Research Group (ERG) issued a Call for Papers to the JANNAF community in support of the upcoming June 2022 JANNAF propulsion conference. This would be the first in-person conference in over two years due to meeting restrictions brought on by the COVID-19 pandemic. During the Modeling and Simulation Subcommittee (MSS) quarterly meeting in October 2021, while discussing the upcoming meeting, the topic of submitted abstracts came up. At the time, zero abstracts had been submitted, and the submission deadline of Dec. 3 was rapidly approaching. As the technical representative of MSS to Johns Hopkins University's ERG, I was a bit nervous that MSS would not be properly represented at the JANNAF conference.

I have always been fascinated by and believed in hypersonics. Indeed, in my early days straight out of graduate school in the mid-1980s, I began working on the National Aerospace Plane (NASP). It seemed like it was a national imperative at that time. So when I was offered the opportunity to attend the University Consortium for Applied Hypersonics (UCAH) 2021 Fall Forum at Texas A&M (College Station, Texas), I felt like I was revisiting topics some of which had been started 30 years earlier. Always on the look-out for the unexpected, the conference held possibilities for papers relevant to the MSS mission.

The Forum was held over the course of two days and featured prominent speakers from the Department of Defense's (DoD) Joint Hypersonics Transition Office (JHTO) and other DoD agencies, U.S. National Laboratories, and academia. In fact, UCAH is a consortium of over 90 academic institutions located in the United States, Australia, and the United Kingdom working within a collaborative network of government, national laboratories, and federally funded research centers (https://hypersonics.tamu.edu/about-us/). The aim of UCAH is the development of the next generation of hypersonic-savvy engineers and scientists dedicated to advancing hypersonic propulsion systems and vehicles.

During the two-day forum, there were short 10-minute presentations of the DoD-funded work ongoing within the academic community: 17 on the first day and 13 on the second day. Out of the 30 presentations, 13 were encompassed by the MSS charter.

Based on the work presented at the UCAH Fall Forum, personal invitations to participate in JANNAF's June 2022 conference were sent, mostly to U.S. universities. ERG received responses from several professors indicating that they would be submitting an abstract for one of the MSS mission areas. However, one academic (and UCAH co-chair), Dr. Kelly Stephani, from University of Illinois at Urbana-Champaign, contacted ERG and suggested that a separate UCAH session be provided at the JANNAF conference. This was based on a similar session being provided at a recent AIAA conference, and the idea that this would be a good experience for the younger professors and graduate students just starting out in their academic careers. Once the format was agreed to, Dr. Stephani reached out to several of her colleagues across academia and convinced them to present. ERG worked with the MSS Chairman, Dr. Michael Watson (NASA-MSFC), to request MSS's sponsorship. Dr. Watson agreed and assigned an MSS member, Mr. Sahil Kabra (Naval Air Warfare Center-China Lake) as co-chair with Dr. Stephani. What started out as a quest to get more papers for the MSS sessions ended up as a specialist session titled "Emerging Capabilities from the University Consortium for Applied Hypersonics (UCAH)."

The original session had a keynote speaker and seven presenters. Unfortunately, the keynote speaker had to withdraw and two presentations could not be cleared in time. Nevertheless, with five presentations, though not all of them strictly speaking MSS-based, the session was very informative and had a sizeable attendance of 75 people.

The last two presenters were actually slated for other MSS sessions, but since their work was funded by UCAH, they were "borrowed" from their sessions to

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MSS UCAH... *continued from page 10*

present at the specialist session. The last paper presented by Dr. Samy Missoum (from the Aerospace and Mechanical Engineering Department at the University of Arizona), titled "A Multifidelity Approach for the Construction of Surrogate Aerodynamic Databases," was originally submitted for an MSS session. His paper generated the most discussion with the audience, and since his paper was the last, Q&A was allowed to go on for 15 minutes (as opposed to 5 minutes for the earlier presenters).

Dr. Samy Missoum presented his team's research on the construction of surrogate aerodynamic databases for hypersonic systems. The objective is to generate a tractable and accurate aerodynamic database that efficiently provides predictions of quantities of interest (e.g., aerodynamic coefficients) and associated uncertainties. The database construction is based on a multifidelity scheme, which leverages the availability of various computational models and wind tunnel experiments.

The presentation generated multiple questions. In particular, there was a question about how the approach would capture complex flow physics phenomena missed by low- or medium-fidelity simulations typically only seen with very expensive simulations or wind tunnel tests. Dr. Missoum's answer was that the objective of the approach is to identify when expensive simulations and wind tunnels are indeed needed, thereby ensuring we use those as little as possible. Although this is the beginning of this research, preliminary results indicate that the approach will help identify cases where wind tunnel experiments or high-fidelity CFD simulations might be needed. Other questions were more related to computational efficiency of the machine learning algorithms themselves. Dr. Missoum did not think this was the main hurdle. He emphasized that there are techniques to make the machine learning approaches more efficient and that the cost associated with the machine learning model construction was considered much less expensive compared to the cost of high-fidelity CFD simulations and wind tunnel tests. Several opportunities for collaboration on the construction of aerodynamic databases were identified after the presentation. For more information, please contact Dr. Missoum at smissoum@arizona.edu.

At the end of the session, I was asked if ERG would be hosting another specialist session at the next spring conference (May 2023, Pittsburgh, Pennsylvania). While attendance was excellent and the Q&A's were dynamic (and just as interesting as the presentations themselves), much will depend on the UCAH community's interest after their Fall Forum in September 2022. ERG is already working with the UCAH leadership to make it happen again for the May 2023 JANNAF Conference. Simply put, hypersonics must be kept on everyone's consciousness. Holding a UCAH-centric specialist session is one way to do that.

Article contributed by Michael "Miki" Fedun, JHU WSE Energetics Research Group, Columbia, MD

RNTS Becomes HTMAS

The Rocket Nozzle Technology Subcommittee (RNTS) has recently expanded to encompass material applications for a broader range of propulsion systems. As a result, it will now be known as the High Temperature Material Applications Subcommittee (HTMAS). The subcommittee will cover the properties, processing, quality assurance, design, testing, evaluation, analysis, and modeling of high-temperature materials for various propulsion systems. These systems include Rocket Nozzle Technology, Hypersonic Systems, Thrust Control, and components of Strategic, Tactical, Space Launch, and other systems. The HTMAS will focus on advanced, high-temperature materials such as carbon-carbon, ceramic matrix, and carbon phenolic composites, CERMETs, refractory metals, and structural/non-structural insulators. The subcommittee will be meeting in the same cycle that held RNTS. The mission areas have been determined for the call for papers; however, the panels are currently being evaluated by the HTMAS TSG. The subcommittee looks forward to the community's participation at its first meeting during the May 2023 JANNAF meeting in Pittsburgh!

ERG Welcomes New Staff

The Energetics Research Group (ERG) recently brought on a number of new staff members who are supporting ERG/JANNAF activities.

Susan Hadden

Susan Hadden joined ERG in April 2022 as the Administrative and Operations Manager, taking over for Debra Eggleston, when she retired from this role after 44 years. Hadden, originally from Virginia Beach, has lived in Maryland since 1996. She was previously the Operations Manager at Interfuze, supporting a DoD program under the U.S. Air Force. The mission was part of Operation Noble Eagle, ensuring the country's sovereign air space, and for the contract, she supported sustainment, upgrade, and maintenance for complex systems placed at locations around the country.

Administrative Manager Susan Hadden

Hadden says she is an organizer and planner by nature and loves to be proactive and one step ahead as much as possible.

"What I do relates directly back to those skills, so I really enjoy my work and being the "hub" of my organization," Hadden said.

In her spare time, Hadden enjoys hockey, reading, traveling, and woodworking. She is currently building a new desk for her home office, and she hopes to get back to international travel in the fall of 2023. Hadden is also working on finishing her Bachelor of Science Degree as well as working on a PMP Certification.

"I'm currently attending Southern New Hampshire University to finally complete my Bachelor's Degree after 30 "gap" years. This time next year I will be graduating with a Bachelor's of Science in Business with a minor in Program Management," Hadden said.

Atashia Allen

ERG has done some organizational restructuring and Gabrielle Delisle-Ballard has been promoted to Communications Specialist and will be supporting the Communications and Publications Team at ERG. Taking on her duties as the Assistant Meeting Planner on the Meetings Team, ERG welcomes Atashia Allen.

Assistant Meeting Planner Atashia Allen

Allen studied at Frostburg University, where she received a Bachelor of Science degree in Mass Communications with a focus in Event Planning.

"I'm interested in everything dealing with events. I love planning and seeing things come to life," Allen said.

In her spare time, she enjoys learning graphic design and is interested in learning online development.

Allen also previously worked at Port Discovery, a children's museum in Baltimore, Maryland. She says she is originally from Baltimore, Maryland, but is ethnically Jamaican.

Claire Shamul

ERG's AERoFuels Laboratory has also experienced some changes over the past few months. Joining the ERG technical staff, Claire Shamul started working at the AERoFuels Lab and supporting JANNAF in December 2021. Alex Bishop left ERG in December 2021 to take a job at Los Alamos National Laboratory.

Technical Representative Claire Shamul

Originally from Long Island, New York, Shamul is a chemical engineer with a Bachelor of Science degree from the University at Buffalo. Upon graduation, Shamul did a year-long internship at LifeSprout, a biotech company in Baltimore, Maryland, before joining ERG.

(See ERG staff on page 17)

ERG Ends Era with Eggleston's Retirement

Debra Eggleston Retires after 44 Years of Dedication to ERG and JANNAF Legacy

ERG is ending an era with the retirement of Debra Eggleston, who has tirelessly supported JANNAF for 44 years. Ms. Eggleston started her career at CPIA in June of 1978. She began as a clerk typist and over the decades ascended to Administrative Manager at ERG. In between, she held the titles of Senior Clerk, Secretary, Administrative Specialist, Administrative Assistant, Administrative Assistant II, and Senior Administrative Assistant. We think of her as the glue that holds ERG together, an operations manager that keeps the gears turning. Until recently she was managing a staff of seven, overseeing the Financial Team, the Security Staff, and the Meetings Team, which plans all of the JANNAF Interagency Propulsion Committee Meetings and Technical Interchange Meetings. She also served as the administrator to the JANNAF Technical Executive Committee. Eggleston has been at ERG longer than anyone else on the current staff. In 44 years, she has attended hundreds of JANNAF-related meetings, worked through four name changes of the current Energetics Research Group, and supported five directors of the organization. Her experience and institutional knowledge of ERG and JANNAF have been invaluable. She has touched many lives serving as manager, mentor, and friend. Following are some tributes to her career at ERG from some of those people:

Debra Sue Barnes recently joined CPIA as a secretary. Her new duties include coordinating the JANNAF Combustion Meetings, organizing and assembling technical meeting bulletins, answering requests for the literature searches which appear in the CPIA Bulletin, assisting in the preparation of Chemical Propulsion Technology Review papers and the CPIA Bulletin, and typing, proofreading, and filing correspondence, minutes, and memoranda. Ms. Barnes is a graduate of Glenelg High School where she received the Business Education Award.

I started at CPIAC right out of school, my first real job if you don't count working summers for my parents' business. The thing is that, despite being a "real job" at a world-leading university and with the awesome responsibility of coordinating the exchange and preservation of the nation's technical information on energetics and rocket propulsion, Debbie made it feel like that small family business. It is cliché and often derided by people in my generation, the so-called work-family, but Debbie made it real. She made everyone at CPIAC, and the broader JANNAF community, feel like a part of something. For my entire career, 15 years now, Debbie has been a constant and steady figure and the same can be said of her for JANNAF – a constant and reassuring presence for the last 44 years despite significant change in the industry and community that surrounds her. As I have grown in my career, I have come to appreciate and respect Debbie even more. As the new Director of Operations at ERG, I have relied on Debbie's wisdom, knowledge, and judgment in all matter of decisions. Individuals as devoted and capable as Debbie are rare, and I'm afraid are becoming rarer still. Thank you Debbie and please enjoy your well-earned, well-deserved retirement! – *Nick Keim, ERG Deputy*

I've always been struck by Debbie's care for her team members, shown through advocacy for our preferences

(See Eggleston on page 16)

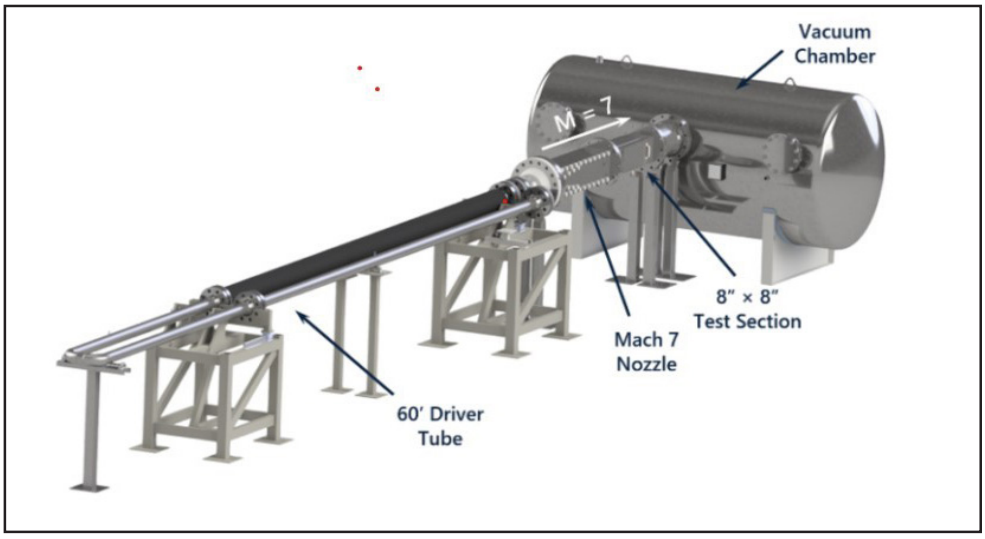
UTSA's Hypersonic Wind Tunnel Test Facility:
A Technical Perspective

Back in January, I was able to visit University of Texas at San Antonio (UTSA's) Mach 7.2 Hypersonic Wind Tunnel Test facility. The facility was completed in April 2021 and since then has been in active use by students who wish to get hands-on experience in state-of-the-art test facilities pertinent to the development of hypersonic vehicles and next-generation weapons systems for the defense of the United States. Recent demonstrations of a Russian Federation Kinzhal hypersonic missile used to attack a subterranean weapons depot in Western Ukraine showed the devastating force and effectiveness of such a system. With the establishment of the Hypersonic Test Facility, UTSA is advancing the next era of hypersonics development by training and testing the next-generation workforce who will be able to immediately enter the industry as professionals and to contribute to the national effort. They may require only minimal additional training, as they will already be familiar with the latest data acquisition equipment to accurately characterize the dynamics of hypersonic vehicles in flight.

The facility is described as a Ludwieg Tube. While rather simple in construction, it allows the experimenter to simulate flight Mach Numbers of 7+, achieve stagnation pressures up to 2,000 psig, test in 800°F at the start of the test, and simulate different atmospheres. For example, it can be used to study reentry dynamics on a simulated space craft entering the Martian atmosphere. The Tube itself is approximately 60 feet long. The selected gas is contained by an etched burst diaphragm just upstream of a two-dimensional nozzle. The students running the experiments decide what pressure they wish to achieve and calculate the etch depth on the diaphragm. At the end of the two-dimensional nozzle, the gas enters an 8-inch-high by 8-inch-wide test section approximately 3 feet in length. Downstream of the test section is a vacuum tank, approximately 1,600 gallons, which collects the originally compressed gas. During any given test, Reynolds numbers of 1.5-600 × 10^6 ft-1 can be achieved. The lab is equipped with a state-of-the-art laser data acquisition system capable of collecting over 1,000,000 data points

Inside the Mach 7.2 Control Room. The room is windowless and designed to withstand accidental rapid pressure release up to 2,000 psig.

photo courtesy of UTSA



Rendering of the UTSA's Mach 7.2 Ludwieg Hypersonic Tube Test Facility.

photo courtesy of UTSA

(See UTSA continued on page 15)

UTSA ... *continued from page 14*

per second. According to the laboratory director, Dr. Chris Combs, an experimenter can get up to four different test scenarios in one shot due to reflected shocks. Total test duration is listed at 500 ms. Since in any given test the steady-state test time is 65-100 ms, over 100,000 data points can be collected during each pass. Dr. Combs said that the facility can perform up to four tests per day.

The facility is essentially operated by students. Dr. Combs commented that the students have such a pride of ownership in the facility that they give him a "dirty look" when he is on site during a test session.

Safety is of paramount concern, especially when dealing with such high pressures. The facility is wired with interlocks between the compressors, the evacuators for the vacuum chamber, the main facility door, and the control room door. Entry is through a card key lock and is regulated to only those students and instructors that need to be there. Pressurization cannot begin until the external facility and control room doors are both locked and the process is initiated from the control room. The control room is equipped with several large screens and computers used for data acquisition and analysis, all partitioned behind the safety of a blast proof wall. The students involved with this hypersonic test facility are required to take a course in Measurement and Instrumentation to learn about modern static and dynamic sensors, temperature measurement devices, and displacement sensors, as well as data and signal processing programs such as MATLAB and Python. Once this kind of experience was gained after graduating with an engineering degree, but today's students at UTSA are getting tremendous exposure to real-world hypersonic problems, as well as the tools to solve them and the opportunity to advance the field of high-speed aerodynamics. In addition to Dr. Combs's leadership and mentoring, students also collaborate with nearby Southwest Research Institute (SwRI) employees who give them insight into real-life issues and pragmatic solutions. When they matriculate, students will be qualified to immediately contribute to some of the best research facilities in the nation. For further information on academic or research opportunities, please contact Dr. Chris Combs at ccombs@utsa.edu.

Article contributed by Michael "Miki" Fedun, JHU WSE Energetics Research Group, Columbia, MD

JANNAF is pleased to announce the following awards presented at the December 2021 JANNAF Meeting

Safety and Environmental Protection Subcommittee Sustained Contribution Award

William Eck, Ph.D.
Army Public Health Command, Aberdeen Proving Ground, Md.

Over 5 years of dedication, enduring support, and outstanding technical contributions to the JANNAF Propulsion Committee. Since 2014, Dr. Eck served as a subject matter expert in the toxicology, fate and transport of new energetic materials being tested, sharing the latest information on health concerns and keeping the community abreast of regulatory changes as part of a service-wide effort to safeguard the health of the warfighter, the worker, and to ensure environmental sustainability.

Propellant and Explosives Development and Characterization Subcommittee Outstanding Achievement Award

Gregory W. Drake, Ph.D.
DEVCOM Aviation and Missile Center, Huntsville, Ala.

Outstanding contributions to the 42nd PEDCS meeting. He served as PEDCS Chair, Lead for Mission Area V, and authored/coauthored three papers. An impressive accomplishment under normal circumstances, this was especially impressive given that this was JANNAF's first virtual meeting, making the job of Session Chair especially challenging. Dr. Drake is also recognized for his broad and deep knowledge of energetics materials, and generosity in sharing this knowledge and his time with junior staff.

Congratulations to all award recipients!

and best interests, one-on-one check-ins, and a readiness to jump in to assist on a task if necessary – just to list a few! I honestly feel that she is a large part of the reason this office has more of a family atmosphere, and I don't know what we are going to do without her encyclopedic knowledge and relaxed personality. She deserves every second of her well-earned retirement, and I hope she enjoys it to the fullest! – *Gabrielle Delisle-Ballard, ERG Communications Associate*

Debbie Eggleston came to us at the tender age of 18. She was a super star from her very first day. As I recall, she was left to handle the office and phones while the rest of the staff celebrated at a luncheon party. Totally undaunted, she came through as the trooper she has always been. I can't say enough about Debbie's dedication to her work, her immediate grasp of the operation and culture, and her diligence in learning all the aspects of the then CPIA. Through the years I watched her grow and blossom into the star performer that this organization was in such need of. From handling personnel issues to budgetary problems to the support of many Government organizations, to working the long hours it took to get the job done, there was literally nothing she wouldn't tackle. And she raised three beautiful daughters through it all! And her pride and joy has been the many grandbabies that came along. I wish you well my dear Debbie -- in the next part of your journey -- you deserve all the happiness a heart can hold -- and now you can watch those Hallmark movies you've been missing!! Ha ha! I love you so very much. - *Karen Brown*

Debbie will be missed as she has been a valuable resource for everyone she interacts with and a good friend. She truly cares about her job, everything relating to JANNAF, and the people she works with. I am personally grateful to have been able to work with and learn from her in my short time at ERG. – *Leslie Thompson, ERG Finance Manager*

Debbie has become a good friend and mentor to me as a manager over the past nine years that I have been at ERG. She is one of the first people I go to when I need advice about an issue or if I need to know a historical detail about JANNAF. She is the first person everyone goes to when they have a question. This place will not be the same. She will be sorely missed, but we all wish her a restful and enjoyable retirement. - *Linda McLean, ERG Communications and Publications Group Manager*

I started working at CPIA in 1986. She was someone you could ask for advice and it was given cheerfully and with much experience behind her answers. She was an admin support person not only for various JANNAF subcommittees but also for DDESB (Dept of Defense Explosives Safety Board) and the JANNAF EC. Debbie created a calm and joyful attitude in the office and she encouraged individual thinking. It was a joy to work with her for 19 years and we have remained friends since my retirement in 2005. - *Dorothy Becker, former ERG staff*

Many, many special events in our lives were attended (!) by Debbie Eggleston!!! Events made even more special by your presence. Happy, celebratory, sad...you were there and we'll always remember your friendship. I wish for you the bestest retirement EVER!!! With lots of trips, down time, being with loved ones, shopping (eh!), fun outings at parks, and indulging in whatever crafty thing(s) you like to do. You have earned it all, Debbie, and made some lifelong friends along the way. Cheers to you, and many Congratulations! YOU were one of the super people that Harry brought with him when we paired up!! I treasure our time together. Love Luanne - *Luanne Hege*

How about that, Debbie, "the face" of this workplace for 44 years? I remember that 18-year old who first reported to CPIA in 1978. You have been a great team member in many capacities and a supportive friend ever since. Your influence has spread far and wide through your work on JANNAF meetings and related activities. You eagerly accepted responsibilities and thrived through your partnership with the great Tom Christian, and continued to do so after he retired. Thank you for the great memories of working together productively on various projects, our enduring friendship, and your efforts to enable me to work for 20+ years as an independent contractor to CPIA/CPIAC, starting when Luanne and I moved far from the Columbia, Maryland office to North Carolina. Happy retirement! (Just out of curiosity, are you staying connected as an independent contractor?) - *Harry Hege, former ERG*

ERG Staff ... *continued from page 12*

She enjoys hands-on problem solving and analysis, as well as learning about different areas of the aerospace industry through JANNAF.

In her spare time, she enjoys running, hiking, and baking.

Nicole Miklus

Nicole Miklus joined ERG in February 2022 as the Managing Editor of the *JANNAF Journal of Propulsion and Energetics*. She oversees manuscripts throughout the review and publication process, works with authors and reviewers, and ensures that manuscripts are published in accordance with publication styles and security standards. She is also responsible for copyediting and layout of the journal and journal marketing and promotion within the propulsion community.

Prior to her current role, Miklus assisted former Managing Editor Benjamin Schwantes with copyediting and layout of the journal from 2016–2021 and served as the Managing Editor from 2012–2014. She has provided technical editing and writing support to NASA, DOE, the U.S. Army Corps of Engineers, and the University of Arizona. Originally from Cleveland, Ohio, she holds degrees in geology—a bachelor's from Kent State University and a master's from Syracuse University.

JANNAF Journal Managing Editor Nicole Miklus

JANNAF Plans to Launch Fellowship Program

The Energetics Research Group (ERG) is excited to announce the creation of a JANNAF Fellowship as part of the recent updates and revisions to the JANNAF Awards Program. The Fellowship's objective is to recognize JANNAF researchers and program managers who have made contributions in limited-distribution research.

The designation of an individual as fellow by a professional organization is a mark of honor that signifies exceptional achievement or service, a commitment to and enrichment of the body of knowledge. For individuals supporting or performing restricted research, recognition by their respective field may be constrained by the need to balance security concerns. Though essential to maintain technological superiority for our nation, the integration of fundamental researchers into applied research teams further limits the ability to celebrate individuals' achievements in the field of propulsion and energetics.

As the nexus of the energetics research community, JANNAF is the ideal organization to address this gap. JANNAF membership and meeting attendees range from the most senior government researchers and program managers to early career and student participants. ERG's secure information sharing platform was developed to facilitate the exchange of technical and programmatic information, and its secure conference facilities and meetings allow access to limited-distribution documents, thereby enabling a secure, fair and objective setting to evaluate prospective Fellows' bodies of work.

Conceived by Eric Welle and supported by Rose Pesce-Rodriguez, the JANNAF Fellowship is envisioned as an integral part of the JANNAF community, led by a committee comprised of Fellows who ensure the highest standards of excellence are demonstrated by all selectees. Like many aspects of JANNAF membership and awards, the JANNAF Technical Executive Committee (TEC) will maintain final approving authority. A limited number of nominations will be accepted from each JANNAF Subcommittee for consideration for either technical or programmatic awards. Posthumous awards to honor the vanguard of U.S. propulsion and energetics research will also be made.

As with any new initiative, the complete benefit to the community may not be immediately apparent or fully realized for years to come. Nominations will be accepted after the official launch of the program, currently slated for December 2022.

JANNAF Family Connections:
Reema and Nicolas Reveles

The JANNAF community can be quite close-knit at times, but for some, it truly is a family affair. In each issue, "JANNAF Family Connections" will highlight a new family in the community that participates in JANNAF together.

Reema and Nicolas Reveles live in Huntsville, Alabama. They both work under the broad aerospace umbrella, have been involved with JANNAF for approximately two years, and both presented at the June 6-10, 2022 conference at the Newport News Marriott at City Center in Newport News, Virginia.

The couple met in graduate school, at Georgia Technical Institute, both pursuing doctorates in aerospace. They branched out into different specializations, Nicolas going into research and development and Reema going into explosion testing and safety. Reema is Chief Engineer at Bangham Engineering, a small local company started by her boss Mike Bangham. She has worked there for the last six years. She jokes that, due to the small number of staff, in a typical day she wears many hats, including training junior engineers and technicians, administrative tasks of ordering supplies for testing, and even janitorial work. However, her focus is primarily on "making space flights safe through explosives testing and analyzing simulations."

Nicolas Reveles, Ph.D., ATA Engineering, Inc., Huntsville, Alabama, and Reema Reveles, Ph.D., Bangham Engineering, Inc., Huntsville, Alabama, pose for a photo with their son.

Nicolas is Senior Project Engineer at ATA Engineering, Inc., a San Diego-based company with a Huntsville, Alabama, office where he has worked since 2014. With an original background in rotorcraft, his focus is currently on signature analysis of vehicles and computer simulations. He also has an interest in acoustics, and is building a "perfect" speaker system. "He went down the rabbit hole for creating the perfect speaker system, and then he started to build his own," Reema laughed. Their three-year-old son is assisting "as much as a three-year old can," according to Nicolas, and "is curious about everything, it doesn't matter what it is." The toddler recently spent time with his grandparents in Colorado while Nicolas and Reema went to the June 2022 JANNAF conference. Both were presenting, so finding reliable childcare was essential, but Nicolas flying to Colorado with his son and then back to the conference was an expensive babysitting option.

"It would be nice if the Marriott had arranged for some sort of childcare," Reema said. "I see this in other fields like computer science where there are more women, but there aren't as many women in aerospace." The situation was also more unique because they were both attending the same conference.

On the plus side, not having to worry about childcare onsite allowed them to spend more time together.

"We were able to meet up for lunch, which normally would never happen, as well as dinner. We were able to stay with a friend who lived within two miles of the venue, so it was like a work vacation," Nicolas said.

Initially, it came as a surprise to them that they would both be presenting at the same conference. Although "we are both broadly aerospace, our areas of work are so very, very different we never expected to be in the same venue," Nicolas said.

Reema has been working on presenting for the last two years, but between the start of the pandemic, writing the papers, getting all the permissions and applications, and a then one-year-old, it was a slow process.

"I had three papers I've been working on, and it all finally came together just in time for the June 2022 conference," Reema recalled. "It also came at a good time, as I was 2 months pregnant at the time of the conference, though there was a concern with the COVID levels. We were careful to always wear masks except when we were presenting. But it was good to network, to see people in-person, to put faces to names of people we had only known via teleconference."

"We did attend each other's sessions, which was nice because normally we wouldn't see that professional side of each other," Reema said. "There was a bit of extra pressure since I've never presented anywhere Nicolas has been, or vice versa." Though they agree "it really wasn't a big deal" in the end. At first there was a mutual concern that they might throw each other off-balance. But, as Reema noted, their relationship "changes when we are in a professional setting, the way we deliver and the way we interact, it's different. So it was nice to see him that way, and to see what work Nicolas is doing and get a feel for his audience and the people he works with. I really enjoyed Nicolas's session."

"But it was really neat to be able to see her presentation," Nicolas said. "She had really cool videos of stuff blowing up, things you wouldn't see day-to-day, and there was this pin-drop silence. Every single person got very, very quiet. The audience reaction was kind of like, 'Oh wow! That's captivating.'"

"And getting that sort of feedback is very helpful," Reema noted. "I would typically get questions from the audience, but not information on how I presented or audience reactions."

While neither has plans to present at the upcoming JANNAF meeting in December, Reema and Nicolas agreed that they will probably go to network and meet-up with colleagues as it will be taking place locally in Huntsville. Reema also may have a paper for the December 2023 session which they are both considering attending together. "JANNAF is a unique venue that has a nice spectrum of different areas," Reema commented, something which makes it more likely they will both be participating in the future.

If you and a parent, child, spouse, or other relative both participate in JANNAF meetings and would like to be featured, please contact Gabrielle Delisle-Ballard at gdelisle@erg.jhu.edu.

Article contributed by Martha Schmidt, JHU WSE Energetics Research Group

JANNAF Journal Volumes 11 and 12

The *JANNAF Journal of Propulsion and Energetics* Volumes 11 and 12 are currently available online, and print copies will be available at the December 2022 JANNAF Conference.

Don't Lose Touch!

We need your help! Please notify Cynthia Beck at ERG (CBeck@erg.jhu.edu / 410-992-7300, ext. 206) if your email address has recently changed. Also, please whitelist emails from the "erg.jhu.edu" domain in your email application. This will permit you to continue receiving timely and important notifications regarding JANNAF events, publications, and other relevant matters.

Combustion Subcommittee Celebrates its 51st Meeting

In January 1964, the Solid Propellant Subgroup of the Interagency Chemical Rocket Propulsion Group (ICRPG) commissioned an ad hoc working group on solid propellant combustion instability. And on May 6, 1964, the working group was formally established as the "Working Group on Solid Propellant Combustion and Combustion Instability." The first meeting, the ICRPG Combustion Instability Conference, was held that same year and generated over 50 papers and presentations.

Since then, the working group has developed into the Combustion Subcommittee (CS) and, after 58 years, continues to serve the JANNAF community as a critical space for technical interchange between DoD, NASA, and the industry. Since the initial conference in 1964, the Subcommittee's meetings have generated over 4,500 technical papers and presentations, thereby preserving and making available their expertise to future generations.

This year marked the Combustion Subcommittee's 51st meeting. Participants gathered in Newport News, Virginia, to share the results of their research, to discuss challenges, and to leverage the capability of these shared experiences into new and exciting programs to advance the state of the art. Their research, challenges, and future advances in combustion science are reflected in the Subcommittee's technical objectives, scope, and specific-topic panels.

Technical Objectives

The Combustion Subcommittee's technical objectives involve the assessment and interpretation of current combustion research and development programs so that engineers and scientists can use this knowledge to build efficient, safe, and stable rocket and gun propulsion systems. Therefore, these efforts are directed toward the early recognition and definition of combustion phenomena, as well as the timely solution of unexpected combustion difficulties for present and planned propulsion systems.

Other objectives include the identification and solution of combustion-related problems for a wide range of interagency propulsion; test devices that employ reacting flows and materials; the coordination of interagency sponsored programs; the establishment of cooperative interagency programs to solve common problems and conduct investigations; the standardization of nomenclature, tests, and test procedures; and the promotion of technical information and data exchange.

Scope

Technical areas within the Subcommittee's scope include analytical modeling and experimental research on chemical combustion phenomena within combustors of solid, liquid, hybrid, and airbreathing missile, space, underwater, and gun propulsion systems. The combustion phenomena encompass steady state, transient, and unsteady processes. Airbreathing topics include fundamental combustion studies of the turbojet, ramjet, scramjet, and combined or mixed-cycle family that are applied to missiles, launch vehicles, hypersonic cruise vehicles, and remotely piloted and uninhabited vehicles.

The Combustion Subcommittee includes the following panels that aid in achieving the scope and objectives. Each panel's technical objectives are described below.

The Kinetics and Related Aspects of Propellant and Explosives Combustion Chemistry Panel develops a consensus of opinion on specific issues of the chemical reaction phenomena that need to be addressed in the areas of modeling, diagnostics, and chemical kinetics as they apply to the behavior of explosives and propellants over a range of lifecycle conditions. In addition, the panel addresses potential means and methods to validate or verify modeling, testing, and diagnostics development.

The Flow Field Diagnostics Panel explores the current state of the art in non-intrusive diagnostics and emerging diagnostic capabilities, areas that can be made more readily available to the propulsion community with encouragement and support from the user (project management) community.

The Reactive Materials Panel makes more effective and efficient use of Reactive Materials (RMs) in weapons systems by exploring the important physics; creating basic and applied research tools; developing candidate Reactive Materials; and developing analytical models capable of fully accounting for Reactive Material effects under a weapons-system effectiveness assessment.

Looking Forward to the Next 50 Meetings

The Combustion Subcommittee continues to actively engage in exciting novel research dedicated to fundamental combustion phenomena, with implications to crosscutting technical areas. The fundamental mechanisms of combustion could involve solid propellant and oxidizer, solid propellant and air, or airbreathing combustion research. The Subcommittee community continues to perform outreach, including soliciting in-progress research papers at JANNAF meetings in order to offer advice and guidance to new engineers in the field.

The Combustion Subcommittee sees the wider JANNAF community as crucial to making contacts for research, forming partnerships with DoD and NASA, and ongoing knowledge transfer to the next generation of combustion researchers. Within these connections, and of particular interest, are the production of research papers with high-fidelity physics-based models, in conjunction with accurate data for grounding and confirming the combustion physics present in the model. The Subcommittee sees this focus on the fundamentals of combustion propellant and chemistry as crucial to the development and understanding of new and enhanced combustion technologies.

As propulsion technology continues to evolve, the Combustion Subcommittee continues to advance the state-of-the-art research into improving burn rate, control, modeling and simulation, and hypersonic combustion. Exciting research into additive manufacturing of solid propellants promises enhanced manipulation of grain boundaries and geometries, with cracks and passages designed to give a precise surface-area-versus-time profile for superior control over burn rate.

Another active area that is essential for future combustion research is hypersonic combustion, currently being investigated to support higher mach scramjet engines and reusable hypersonic vehicle designs. In addition to hypersonic combustion, there is sustained interest in fundamental modeling and characterization of turbulent combustion chemistry, high- and low-pressure combustion kinetics, combustion stability, and green monopropellant characterization and chemistry. Such topics continue to be of interest, and are frequent in town hall meetings by the Combustion and other related Subcommittees during JANNAF conferences, often spurring insightful and crosscutting discussions around the needs of the propulsion community at large. As the field of combustion science continues to move forward, the Combustion Subcommittee remains committed to investigating and providing the highest quality discussions on fundamental combustion phenomena that enable the next generation of combustion devices and propulsion systems.

The *JANNAF Journal of Propulsion and Energetics* is seeking reviewers and associate editors. To be eligible, you just need an active JANNAF account.

*** If interested, please contact Nicole Miklus at Nmiklus@erg.jhu.edu with your subject matter expertise.**

*** Reviewers and associate editors at a university are also required to provide dates of CUI/export compliance briefings.**

In Memoriam

Dr. Richard Henley Woodward "Woody" Waesche passed away Nov. 4, 2021, surrounded by family. He leaves behind two children, Charles Russell Waesche and Ann Spotswood Waesche, and eight nieces and nephews. An eminent rocket scientist, Woody was born in Baltimore, Maryland, on Dec. 20, 1930 and graduated from Williams College in 1952 with a degree in Physics. After graduation, he served in the U.S. Army's Ordnance Corps and was stationed at Redstone Research Laboratory, Huntsville, Alabama, where he met his wife of over 60 years, Lucy Spotswood Waesche (White). They were married until her death in 2019.

His work in the 1950s led to the choice of the appropriate type of aluminum to ensure smooth combustion inside solid rocket motors. Woody attended Princeton University where he earned a master's in 1962, followed by a Ph.D. in 1965 in Aerospace and Mechanical Sciences as a Guggenheim Fellow. He loved to recall his contemporaries and their shared heroics on the Princeton Guggenheim Labs softball team. He also frequently recalled the editorial and physics lessons learned from his mentor and taskmaster, Martin Summerfield, to “Get the physics right” and take no time off.

Woody’s Ph.D. dissertation research (DOC number AD634278) in pursuit of entropy waves pertaining to rocket motor combustion instability was among the most difficult. The absence of entropy waves defined new directions in reacting flow research, as well as good-natured banter on such elusive waves. Two excellent 1960s ICRPG Combustion Conference papers resulted from his research.

Woody Waesche (1930-2021)

In 1966, Woody became a Senior Research Engineer at United Technologies Research's Propulsion Laboratory in East Hartford, Connecticut, where he managed programs to develop combustion for air-launched missiles. Woody and his growing family lived in nearby Glastonbury, Connecticut, until 1981. A specialist on numerous rocket-based initiatives, Woody became Principal Scientist in the Propulsion Division at Atlantic Research Corporation (ARC) in Gainesville, Virginia, in 1981. Of note was his advisory work for NASA, where his studies and findings on the Space Shuttle's flow field after the 1986 Challenger disaster allowed for continued operation of the Shuttle. In 1993, Woody left ARC to become Principal Scientist at Science Applications International Corporation, in Reston, Virginia, developing tactical systems and aiding our nation's defense by performing analyses of world-

1971 JANNAF Combustion Meeting, Monterey, Ca., from left Bo Stokes, Dick Cole, Joyce Caveny, Woody Waesche, Martin Summerfield, Thom Boggs, Jane and Bob Lyles, Len Caveny, Dave Flanigan
Photo courtesy of Stuart Blashill

wide energetic-material and propulsion technologies. Throughout his career, Woody was a fellow at the American Institute of Aeronautics and Astronautics (AIAA), where he served on the Board of Directors and was Director of the Propulsion and Energy Group. A specialist in solid rocket motor combustion and internal ballistics, Woody was also editor-in-chief for numerous journals, including *The Journal of Propulsion and Power* for 14 years. In addition to authoring award-winning papers and publications in the field of rocket propulsion, Woody was a member of the Combustion Institute, International Pyrotechnics Society, National Defense Industry Association, and Sigma Xi. He received countless industry awards throughout his illustrious career, including a recognition award and two best paper awards from JANNAF. He was a perennial contributor and session chair for JANNAF meetings.

Woody was known as a renaissance man with a broad intellect and deep range of interests. He was well versed in European travel and lore, and enjoyed using his knowledge of language, particularly Russian. Len Caveny recalls that traveling with him to a New Trends in Research of Energetic Materials (NTREM) meeting in Pardubice, Czech Republic, was the equivalent of Cook's Tour.

Woody was renowned for his operatic bass voice and was soloist and cantor at many churches and synagogues in Hartford, Connecticut, and Washington, D.C. He performed at St. John's at Lafayette Square, The National Cathedral, and sang in numerous performances of Handel's Messiah and Mozart's Cosi Fan Tutte and Don Giovanni. He was a member of the choir at Grace Episcopal Church in The Plains, Virginia, for over 20 years, and also sang operatic roles with members of the Metropolitan Opera and the Hartford Symphony. Len Caveny recalled that at the 1970 JANNAF Combustion Meeting, held at the John Hopkins Applied Physics Laboratory, a grand piano happened to be on the stage and during the breaks Woody demonstrated his mastery of music.

Professor Tatyana S. Pivina, of the Zelinsky Institute of Organic Chemistry, paid the following tribute showing the great admiration Woody inspired in international as well as local communities. "This news infinitely saddens everyone who knew Woody - this amazingly beautiful person, a brilliant professional, a teacher beyond the barriers of nationalities and traditions. His exceptional interest and unfailing benevolence, his professionalism and sense of humor disposed to him all who had the good fortune of getting to know him. His singing in a velvet bass (I know that he was a great admirer of Feodor Chaliapin) adorned the informal feasts of many scientific forums. His death is an unhealed wound and pain forever."

Revised from Hartford Courant on Nov. 14, 2021.

In Memoriam

It is with great sadness we report the passing of Mr. Edward A. Daugherty, who died on June 16, 2022 at 92 years old.

Ed, working with General Michel Thevenin and Dr. Ron Derr, was a principal contributor to the creation of the Pilot NATO Insensitive Munitions Center (NIMIC) that ultimately became NIMIC and later Munitions Safety Information Analysis Center (MSIAC). While helping develop the concept of NIMIC, Ed served as Project Manager and directed the transfer of Pilot NIMIC from Columbia, Maryland to NATO Headquarters in Brussels, Belgium in May 1991. After NIMIC was established, he continued to support and promote NIMIC and later MSIAC.

Before his activities in NIMIC, Ed was Chairman of the U.S. Navy Weapons Systems Explosives Safety Review Board (WSESRB) for 14 years. In this capacity, he headed the Navy's independent oversight for safety compliance of

Ed Daugherty (1930-2022)

(See Daugherty continued on page 26)

Daugherty... *continued from page 25*

all Department of the Navy military munitions. This included energetic systems, weapons, weapon devices, and those systems that manage and control weapons used, handled, stored, or tested on Navy ships and aircraft.

In 1982, working with Mr. Ray Beauregard and a team of Navy explosives formulation and detonation physics experts, Ed helped conceive the U.S. Navy Insensitive Munitions Program. This program was envisioned to be a structured, disciplined engineering process for the development of new energetic materials that would be less sensitive to unplanned stimuli than materials used at that time. Without Mr. Daugherty's vision, first-hand knowledge, and understanding of weapon safety issues, based on his WSESRB experience, the Navy's insensitive munitions program may never have reached fruition. He was the behind-the-scenes, driving force promoting this initiative.

Ed was an active participant in JANNAF. In 1987 until early 1991, he was chairman of the Safety and Hazard Classification Panel under the Propulsion Systems Hazard Subcommittee (PSHS). Ed received the JANNAF Executive Committee Certificate of Recognition for work with that panel.

In 2019, Ed received the MSIAC Award for Munitions Safety Career Achievements.

Ed is survived by his wife of 55 years, Judith Daugherty, and their twin sons, Michael and Brian Daugherty.

Courtesy of Dr. Ronald Derr

ERG Celebrates 75th Year

The Energetics Research Group (ERG) recently marked its 75th year of providing support to the aerospace and defense communities. Specializing in the research, development, analysis, and publication of technical work in the fields of propulsion and energetics, the ERG has a long and rich history of sharing resources and building connections between the public, private, and academic sectors.

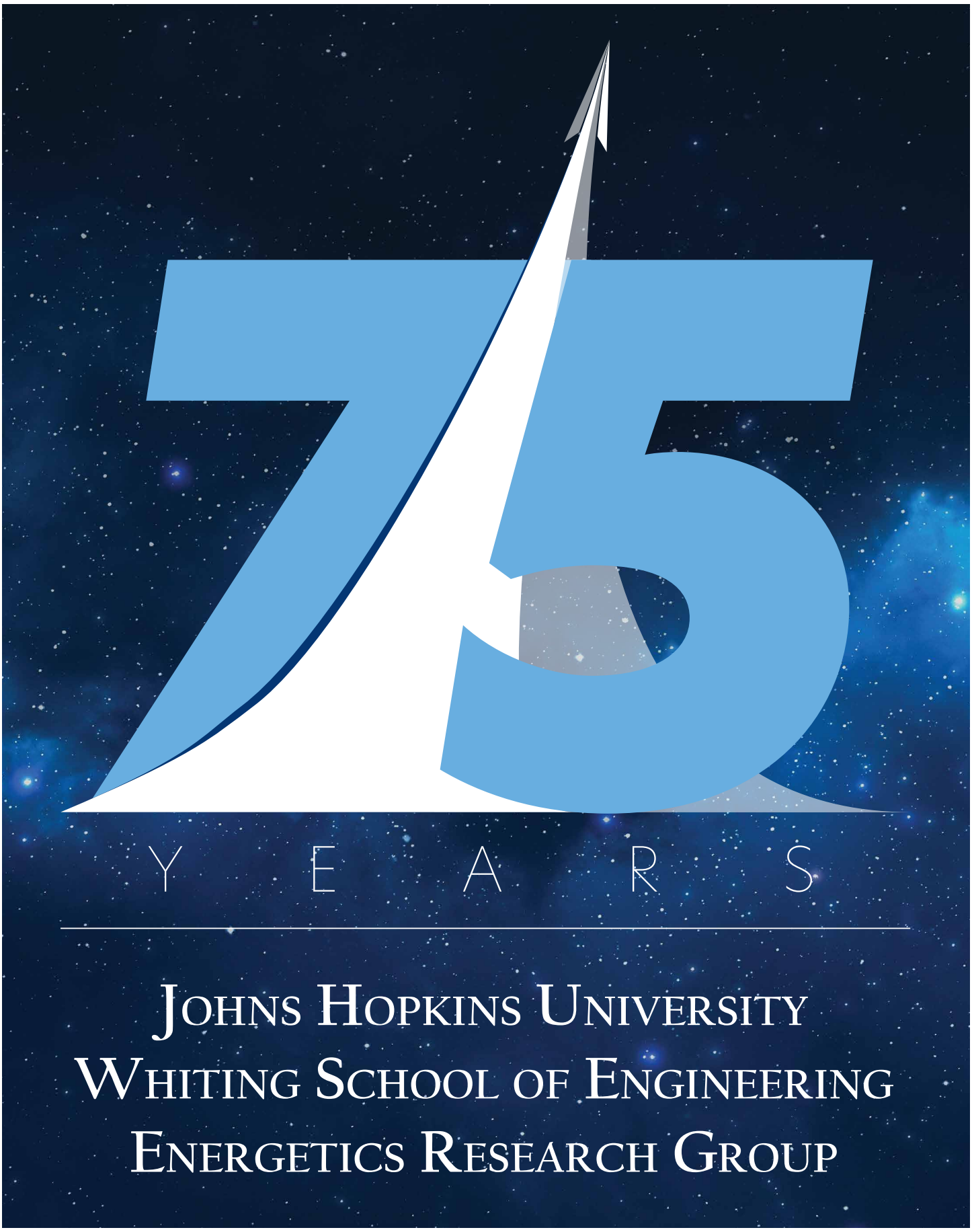
The ERG started in 1946 as the Rocket Propellant Information Agency (RPIA) at the Johns Hopkins University (JHU) Applied Physics Laboratory (APL) and transitioned to the Solid Propellant Information Agency (SPIA) in 1948 and then the Liquid Propellant Information Agency (LPIA) in 1956. When the Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee's predecessor—the Interagency Chemical Rocket Propulsion Group (ICRPG)—merged the SPIA and LPIA into two groups in 1962, the Chemical Propulsion Information Agency (CPIA) formed and became a DoD Information Analysis Center (IAC) in 1964.

The CPIA moved from APL to the JHU Whiting School of Engineering in 1990 and became the Chemical Propulsion Information Analysis Center in 2005, followed by the Center for Aerospace–Defense Research and Engineering (CADRE) and, finally, ERG in 2015. Today, the ERG serves as a trusted and objective resource as it has for the past 75 years. It also continues to provide technical and administrative support to JANNAF.

The ERG offers a variety of products and services while adjusting and expanding in response to evolving needs and new technologies. In-person and virtual meetings give attendees a venue for energizing discussions. Workshop proceedings, handbooks, databases, and special publications provide valuable archival and updated reference information. The *JANNAF Journal of Propulsion and Energetics* offers both a print and electronic venue for publication of limited-distribution work, and the *JANNAF News* informs the community of current events. A technical and bibliographic inquiry service delivers accurate answers from ERG staff experienced in the propulsion industry, and original research conducted at ERG's Advanced Engine & Rocket Fuels (AERoFuels) Laboratory leads the field.

These are just a sampling of what the ERG has available. Further information on products and services and how to access them can be found in this newsletter as well as on the JHU ERG (http://erg.jhu.edu) and JANNAF (http://jannaf.org) websites.

Although the ERG has had various names throughout its history, the overriding mission is still the same. The coming years will undoubtedly bring more change, but the dedicated staff of the ERG will continue proudly serving both new and long-time members of the propulsion community. The ERG would like to thank you for your continued trust and support. Here's to another 75 years!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