

# JANNAF INTERAGENCY PROPULSION COMMITTEE

## JOINT ARMY-NAVY-NASA-AIR FORCE



Liquid Propulsion Subcommittee (LPS)

Advanced Materials Panel (AMP)

Additive Manufacturing for Propulsion Applications

Technical Interchange Meeting (TIM)

**27-28 August 2018**

**NEW deadline date for submission of abstracts is 6 June 2018.**

## Announcement and Call For Presentations



This Technical Interchange Meeting (TIM) will bring together leading experts from the propulsion community to discuss the most advanced technologies in additive manufacturing that are being applied to propulsion components. This forum will be conducive to collaboration and sharing ideas for recent advances and needs for future development. Additive manufacturing is enabling entirely new design approaches and is vital for reducing manufacturing time and cost. As affordability is becoming increasingly critical for space launch systems, new and innovative manufacturing techniques are becoming a mainstream approach to manufacturing. As additive manufacturing becomes more widely accepted for general use, it is necessary to comprehensively understand the area in order to proceed with implementation of the technology into spaceflight applications requiring a high level of reliability.

The Joint Army-Navy-NASA-Air Force (JANNAF) Liquid Propulsion Subcommittee (LPS) Advanced Materials Panel will host an Additive Manufacturing for Propulsion Applications TIM on August 27-28, 2018, in Huntsville, Alabama at the Jackson Center. NASA and the propulsion community are committed to overcoming the challenges to widespread adoption of additive manufacturing into new propulsion systems. NASA, other agencies, industry and academia have realized unprecedented advances additive manufacturing research and technology development for materials, design, manufacturing, and certification. This TIM is intended to share the results of these efforts, to encourage organizations with similar interests, and provide insight into the plans for future developments.

## ATTENDANCE

The overall security level of the meeting is Unclassified. All sessions will be held at the Jackson Center in Huntsville, Alabama. Attendance is restricted to U.S. citizens qualified to receive unclassified, limited-distribution information. To qualify, the attendee must be employed by a DoD, DoE, or NASA facility, or with a DoD, DoE, or NASA contractor facility. No foreign nationals will be permitted to attend.

**ALL non-government attendees** (which includes contractors, consultants and universities) attending this meeting **must**:

1. Be certified by a Sponsoring Government Official
2. Provide their organization's DD 2345 Certification Number for receipt of militarily-critical technical data

**DD 2345:** For additional information, contact the [Joint Certification Program Office \(JCP\)](#) at 1-800-352-3572 or visit their Web site at.

All attendees will be required to register via the JANNAF Secure Portal. Portal accounts are complimentary so if you do not currently have an account, please visit the JANNAF web-site at [www.jannaf.org](http://www.jannaf.org) to begin the process. Questions concerning attendance eligibility or establishment of a secure portal account should be directed to the JHU-WSE ERG Facility Security Officer, Mary Gannaway at (410) 992-7304, ext. 211 or [mtg@jhu.edu](mailto:mtg@jhu.edu).

## PURPOSE

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

The purpose of the LPS Advanced Materials Panel is to provide a forum for exchanging material and related data to aid in the application of materials to rocket propulsion components and to motivate the development of new materials and processes.

## SCOPE

The scope of the JANNAF LPS Advanced Materials Panel Additive Manufacturing for Propulsion Applications TIM includes:

- I. Design for Additive Manufacturing
- II. Additive Manufacturing Modeling and Simulation
- III. Material Development and Characterization Testing
- IV. Additive Manufacturing Techniques & In-situ Monitoring
- V. Post-Processing: Heat Treatment, Surface Finish Modification, NDE
- VI. Component and System Testing
- VII. Process Qualification & Flight Certification

## SESSION AREAS/SPECIALIST SESSIONS

The only Session Areas noted in this Call for Presentations are for the JANNAF AMP Additive Manufacturing for Propulsion Applications TIM as these are the areas for which the submittal of abstracts is particularly encouraged at this time.

## ABSTRACT SUBMITTAL PROCESS

- It is acceptable for this conference to submit presentation charts only. Papers are welcome, but presentation charts are sufficient. Whether the author submits a paper or charts only, an abstract is still required.

- Presentations will be given an approximate 30-minute time slot, of which 20 minutes should be for the planned presentation and 10 minutes for audience questions.
- The technical areas to be addressed are defined in this announcement. Individuals who wish to submit an abstract should carefully review the areas and complete and submit the electronic abstract form provided with this announcement.
- Submit only unclassified abstracts. Abstracts will not be published and will only be used by the program committee members for paper selection purposes.
- Obtain management approval on the abstract form to ensure availability of resources for your participation.
- Many organizations require abstracts to be processed through an approval system prior to submission. This process takes additional time, so authors should plan accordingly in an effort to meet the abstract deadline date.
- The **NEW** deadline date for submission of abstracts to ERG is **6 June 2018**.

- Complete the “Add Document” form, being sure to Title your Document, mark “Upload from Client”, click the “Browse” button and navigate to where you have saved your completed abstract submittal form on your computer. Select the file and click “open”. Choose the appropriate file format (MS Word or PDF) under Document Type, and click on “Apply”.
- Email [mtg@jhu.edu](mailto:mtg@jhu.edu) to notify that the file has been successfully uploaded.

ERG accepts only electronic submission of abstracts and papers. Electronic abstracts are due at ERG **NEW deadline: 6 June 2018**. Abstracts may be submitted:

- Via email to: [mtg@jhu.edu](mailto:mtg@jhu.edu)
- Mailed on CD-ROM to JHU/WSE-ERG, Attn: LPS/ Advanced Materials Panel, 10630 Little Patuxent Parkway, Suite 202, Columbia, MD 21044-3286; **OR**
- Uploaded to ERG’s secure server as follows:
  - Go to <https://www.erg.jhu.edu/>
  - Under Tools (lower right side of page), click Document Submittal
  - Type in User Name: Abstract
  - Type in Password (contact ERG (410) 992-7300 for current password)
  - Choose Infobase: JANNAF Mtg Abstract Uploads
  - Click the “Login” button.
  - Click on “August 2018 Additive Manufacturing TIM; choose Add Document (to the left of the page)

## AUTHOR TIMELINE

Date	Weeks before Meeting	Action
<b>6-June</b>	12	<b>NEW Deadline for receipt of abstracts.</b>
21-Jun	10	Acceptance/rejection letters sent to authors.
5-Jul	8	Deadline for changes to meeting invitation and preliminary program.
12-Jul	7	Invitation, preliminary program, and registration materials forwarded to propulsion community.
16-Aug	2	Deadline for receipt of charts and clearance forms.
16-Aug	2	Deadline for receipt of registration certification forms.
27-Aug	0	JANNAF AMP Additive Manufacturing for Propulsion Applications TIM

## JANNAF AMP ADDITIVE MANUFACTURING FOR PROPULSION APPLICATIONS TIM SESSION AREAS

The TIM will cover systems development within the seven session areas described below. Additional information concerning these areas or the topics being solicited should be directed to the respective Area Chair.

### Session Area I: Design for Additive Manufacturing

Co-Chair: Will Brandsmeier, NASA/MSFC

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Co-Chair: (TBA)

Telephone:

Email:

This session area will discuss the design methodology for additive manufacturing that can radically differ from other manufacturing processes due to the highly controlled nature of the part production and the ability to create shapes unachievable with conventional manufacturing. For example, a part can be optimized for weight by removing all unnecessary material while remaining structurally sound. Optimizing designs to take full advantage of the machines' capabilities, while developing optimized orientations, supports and other structures for manufacturing, is a key issues that can affect economical part production. Designing to minimize time for production and lower manufacturing costs is also a challenge. This session seeks to address these and related issues of integrating the part design process with additive manufacturing's new capabilities.

### Session Area II: Additive Manufacturing Modeling and Simulation

Co-Chair: Ed Glaessgen, NASA/LaRC

Telephone: (757) 864-8947

Email: [e.h.glaessgen@nasa.gov](mailto:e.h.glaessgen@nasa.gov)

Co-Chair: Nima Shamsaei, Auburn University

Telephone: (334) 844-4839

Email: [shamsaei@auburn.edu](mailto:shamsaei@auburn.edu)

The presentations in this session focus on modeling and simulation of additive manufacturing processes. Potential topics include: Simulation of AM processes to predict residual stresses, microstructure, and/or surface topology; modeling of AM processes to consider the resultant effect of print direction, part orientation, and/or power level; modeling and simulation of support structures; and, the use of modeling and simulation for process and part certification and qualification; as well as other related topics.

### Session Area III: Material Development and Characterization Testing

Co-Chair: David L. Ellis, NASA/GRC

Telephone: (216) 433-8736

Email: [david.l.ellis@nasa.gov](mailto:david.l.ellis@nasa.gov)

Co-Chair: Michael Kirka, Oak Ridge National Laboratory

Telephone: (865) 946-3163

Email: [kirkamm@ornl.gov](mailto:kirkamm@ornl.gov)

This area focuses on exploring the development of new materials and process parameters for additive manufacturing. Emphasis should be on parameter development, microstructural characterization, physical, thermal, and mechanical property testing leading to robust material properties.

### Session Area IV: Additive Manufacturing Techniques & In-situ Monitoring

Co-Chair: Nicholas Mule, Aerojet Rocketdyne

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Email: [nicholas.mule@rocket.com](mailto:nicholas.mule@rocket.com)

Co-Chair: John Middendorf, AM Univ Technology Corp.

Telephone:

Email: [jmiddendorf@utcd Dayton.com](mailto:jmiddendorf@utcd Dayton.com)

This session area addresses development of new or novel additive manufacturing processes, machine best practices, and assessment of in-situ process monitoring techniques. Development of systems capable of in-process sensing and/or control during additive manufacturing will be an essential part of verifying the quality of complex parts. New additive manufacturing processes for metals, polymers, and electronics are being developed that could enable the next phase of the evolution of additive manufacturing. Discussion on technology maturation, novel processes such as hybrid or friction stir systems, and best practices for machine operation is also encouraged.

### Session Area V: Post-Processing: Heat Treatment, Surface Finish Modification, NDE

Co-Chair: Owen Hildreth, Arizona State University

Telephone: (480) 965-4912

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Co-Chair: Judith Schneider, University of AL Huntsville

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Email: [jas0094@uah.edu](mailto:jas0094@uah.edu)

After components are built using additive manufacturing techniques, sometimes post build processing and inspection is required. This forum will discuss the various post build processing and finishing techniques. This can include (but is not limited to) heat treatment, stress relief, slurry honing, surface finishing, drilling, milling and welding. Inspection of the additively manufactured hardware is a common issue for additive manufacturing. This technology enables complex geometries that present new challenges in terms of inspection of critical features that are not easily accessed. Presentations on nondestructive examination techniques are encouraged.

### Session Area VI: Component and System Testing

Co-Chair: Paul Gradl, NASA/MSFC

Telephone: (256) 544-2455

Email: [paul.r.gradl@nasa.gov](mailto:paul.r.gradl@nasa.gov)

Co-Chair: Brian Webb, Aerojet Rocketdyne

Telephone: (818) 586-0858

Email: [brian.webb@rocket.com](mailto:brian.webb@rocket.com)

This session area will discuss various programs and projects where unique components were built to either reduce time and cost, or to produce a novel component that could not have been produced using alternative manufacturing processes. Components that were taken through fabrication and into a test program are desired, although new and innovative parts that were only taken through manufacturing are also encouraged.

### Session Area VII: Process Qualification & Flight Certification

Co-Chair: Mohsen Seifi, ASTM International

Telephone: (202) 904-2834

Email: [mseifi@astm.org](mailto:mseifi@astm.org)

Co-Chair: Rick Russell, NASA/KSC

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This session will explore the state of additive manufacturing qualification and certification processes. Specifications developed by government and industry for the qualification of processes and the certification of hardware are crucial for the widespread application of additive manufacturing. The processes codified in these specifications are the key to ensuring that new and innovative technologies, such as AM, meet requirements for flight hardware. Presenters will highlight the accomplishments and challenges in developing, tailoring, applying, and certifying AM technologies from the materials, processes, and quality control perspectives.

### (TIM) PROGRAM COMMITTEE MEMBERS

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