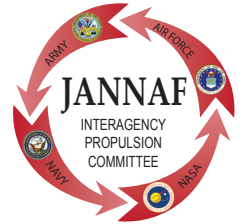


# JANNAF INTERAGENCY PROPULSION COMMITTEE

## JOINT ARMY-NAVY-NASA-AIR FORCE

Liquid Propulsion Subcommittee (LPS)  
Advanced Materials Panel (AMP)  
Additive Manufacturing for Propulsion Applications  
Technical Interchange Meeting (TIM)  
**23-25 August 2016**



## Announcement and Call For Presentations



The Joint Army-Navy-NASA-Air Force (JANNAF) Liquid Propulsion Subcommittee, Advanced Materials Panel is conducting an Additive Manufacturing for Propulsion Applications Technical Interchange Meeting on Tuesday through Thursday, 23-25 August 2016, at the Jackson Center in Huntsville, Alabama.

## 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 [www.dlis.dla.mil/jcp/](http://www.dlis.dla.mil/jcp/).

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 Assistant Facility Security Officer, Tricia Reider at (410) 992-7300, ext. 222 or [treider@erg.jhu.edu](mailto:treider@erg.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. Component Fabrication and Test
- II. Additive Manufacturing Techniques and Machines
- III. Post Build Processing, Finishing, and Inspection
- IV. Materials
- V. Design for Additive Manufacturing
- VI. Modeling and Simulation
- VII. Process Qualification & Specifications
- VIII. Process Analysis, Sensing, and Control, Non-Destructive Evaluation
- IX. Special Topics
- X. Future Needs

## 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 a 30-minute time slot, of which 20 minutes should be for the planned presentation and 10 minutes should be left 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 deadline date for submission of abstracts to ERG is **April 29, 2016**.

ERG accepts only electronic submission of abstracts and papers. Electronic abstracts are due at ERG by **April 29, 2016**. Abstracts may be submitted:

- Via email to: [kbiglari@erg.jhu.edu](mailto:kbiglari@erg.jhu.edu)
- Mailed on CD-ROM to JHU/ERG, Attn: LPS/Advanced Materials Panel, 10630 Little Patuxent Parkway, Suite 202, Columbia, MD 21044-3286; **OR**
- Uploaded to CPIAC’s secure server as follows:
  3. Go to <https://www.erg.jhu.edu/>
  4. Under Tools (lower right side of page), click Document Submittal
  5. Choose Infobase: JANNAF Mtg Abstract Uploads
  6. Type in User Name: Abstract
  7. Type in Password (contact ERG (410) 992-7300 for current password)
  8. Click the “Login” button.
  9. Click on “2016 LPS & AMP-Additive Manufacturing for Propulsion Applications TIM-ABSTRACT UPLOAD”; choose Add Document (to the left of the page)
  10. 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”.
  11. Email [kbiglari@erg.jhu.edu](mailto:kbiglari@erg.jhu.edu) to notify that the file has been successfully uploaded.

## AUTHOR TIMELINE

Date	Weeks before Meeting	Action
29-April	16	Deadline for receipt of abstracts.
17-Jun	9	Acceptance/rejection letters sent to authors.
01-Jul	7	Deadline for changes to meeting invitation and preliminary program.
08-Jul	6	Invitation, preliminary program, and registration materials forwarded to propulsion community.
05-Aug	2	Deadline for receipt of charts and clearance forms.
05-Aug	2	Deadline for receipt of registration certification forms.
23-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 ten 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: Component Fabrication and Test

Chair: Adam Naramore, Orbital ATK

Telephone: (410) 392-1755

Email: [Adam.Naramore@OrbitalATK.com](mailto:Adam.Naramore@OrbitalATK.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 II: Additive Manufacturing Techniques and Machines

Chair: Jamie Malak, Air Force Research Laboratory

Telephone: (661) 275-5539

Email: [Jamie.Malak@us.af.mil](mailto:Jamie.Malak@us.af.mil)

This area focuses on exploring different additive manufacturing techniques currently in use or in development. Emphasis should be on advancing the state of the art, exploring new, larger builds, innovative techniques, and machines that can achieve component builds with more robust material properties compared to traditional machines.

### Session Area III: Post Build Processing, Finishing, and Inspection

Chair: Karen Taminger, NASA LARC

Telephone: (757) 864-3131

Email: [Karen.M.Taminger@nasa.gov](mailto:Karen.M.Taminger@nasa.gov)

After components are built using additive manufacturing techniques, sometimes post build processing 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.

One common issue with additive manufactured components is the ability to inspect the components, particularly those with complex internal geometries. While an advantage of additive manufacturing is being able to combine several parts that were once welded together, now new challenges present themselves

in terms of inspection of critical features that are not easily accessed. Presentations on post build finishing and inspection techniques and challenges are encouraged.

### Session Area IV: Materials

Chair: Dr. David L. Ellis, NASA GRE

Telephone: (216) 433-8736

Email: [David.L.Ellis@nasa.gov](mailto:David.L.Ellis@nasa.gov)

Material development is critical for the success of additive manufacturing. This session will discuss materials that have been used with additive manufacturing, new materials, gradient materials, and powder certification.

### Session Area V: Design for Additive Manufacturing

Chair: Elizabeth Robertson, NASA MSFC

Telephone: (256) 544-9692

Email: [elizabeth.robertson@nasa.gov](mailto:elizabeth.robertson@nasa.gov)

The design methodology for additive manufacturing 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 VI: Modeling and Simulation

Chair: Dr. Phillip A. Farrington, University of Alabama in Huntsville

Telephone: (256) 824-6568

Email: [farrinp@uah.edu](mailto:farrinp@uah.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 VII: Process Qualification and Specifications

Chair: Kristin Morgan, NASA MSFC

Telephone: (256) 544-1025

Email: [kristin.l.morgan@nasa.gov](mailto:kristin.l.morgan@nasa.gov)

This session will explore the state of additive manufacturing (AM) qualification and certification processes for propulsion applications. AM approaches can offer benefits to reduce lead times and costs and to introduce new approaches to design and manufacturing. Much development progress has been made in the areas of materials and processes, while significant challenges still remain, especially with respect to quality and inspection and the qualification and certification processes. These processes 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, applying, and certifying AM technologies from the materials, processes, and quality control perspectives.

## Session Area VIII: Process Analysis, Sensing, and Control, Non-Destructive Evaluation

Chair: Darrell Gaddy, NASA MSFC

Telephone: (256) 544-0198

Email: [darrell.e.gaddy@nasa.gov](mailto:darrell.e.gaddy@nasa.gov)

This session area addresses work that is being performed to assess additive manufacturing processes, including in-process sensing and controls (e.g. Infrared thermography). Also included is the thermal and/or structural modeling of the processes. Non-destructive evaluations (during the build) are also encouraged.

## Session Area IX: Special Topics

Chair: Alison Park, Aerojet Rocketdyne

Telephone: (661) 313-7691

Email: [Alison.Park@rocket.com](mailto:Alison.Park@rocket.com)

This session is seeking topics not covered by the other AM sessions. This could include work in multi-material AM, hybrid systems which integrates AM and CNC machining and welding for example. The purpose of this session is to look at AM concept expanders.

## Session Area X: Future Needs

Chair: John Vickers, NASA MSFC

Telephone: (256) 544-3581

Email: [john.h.vickers@nasa.gov](mailto:john.h.vickers@nasa.gov)

The session presentations will be a combination of invited presentations and abstracts selected from industry, government, and academia. We are seeking presentations that project beyond the current state-of-the-art technologies and research advancements of additive manufacturing in focus areas including: design, materials (e.g. materials science, composites, multi-functional), next-generation processes/equipment, integrated modeling/digital twin/physics based/analysis, NDE/inspection/testing, and sensors/controls.

## (TIM) PROGRAM COMMITTEE MEMBERS

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Member: Bob Carter, NASA GRC

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