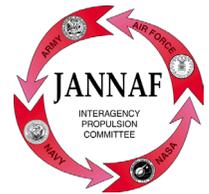


JANNAF INTERAGENCY PROPULSION COMMITTEE
JOINT ARMY-NAVY-NASA-AIR FORCE

Green Monopropellant Alternatives to Hydrazine

Joint JANNAF / NIRPS

Technical Interchange Meeting (TIM)

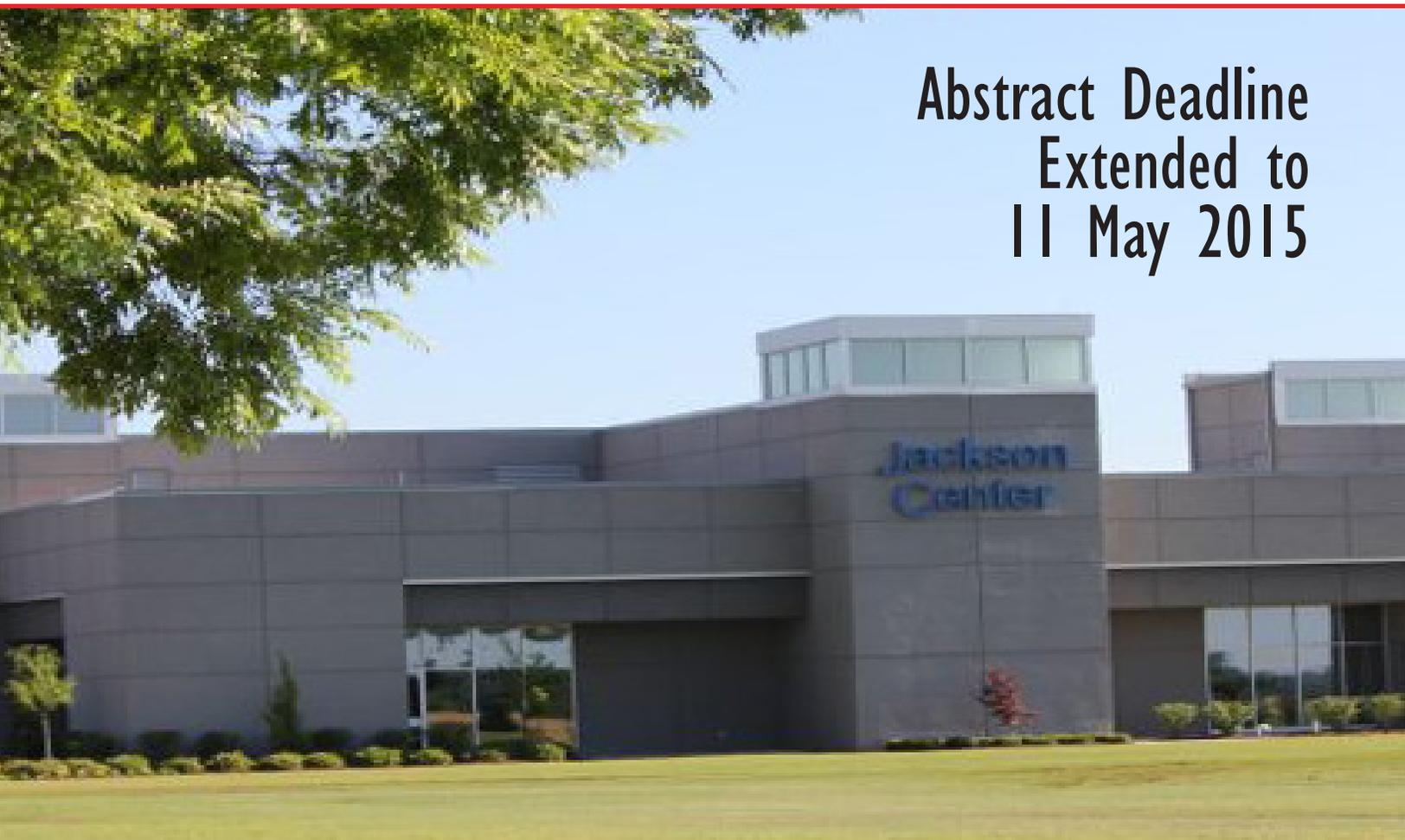


NIRPS

4 - 5 August 2015

Announcement and Call For Presentations

Abstract Deadline
Extended to
11 May 2015



Spacecraft propulsion and power for many decades has relied on hydrazine monopropellant technology for auxiliary power units, orbital circularization, orbit raising and lowering and attitude control. It has been a mainstay for propulsion engineers due to its simplicity and dependability. However, hydrazine is toxic, has a wide flammability range and is corrosive. Within the past few years, less toxic (green) monopropellant alternatives have surfaced that present better performance and handling characteristics than hydrazine. Before these green propellants are widely accepted for general use, it is necessary to understand the technology well enough to proceed with a high level of confidence.

The Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee and The National Institute for Rocket Propulsion Systems (NIRPS) will host this Green Monopropellant Alternatives to Hydrazine Technical Interchange Meeting (TIM) on Tuesday and Wednesday, 4 - 5 August 2015, 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/.

Questions concerning attendance eligibility should be directed to the JHU/CPIAC Facility Security Officer, Mary Gannaway, at (410) 992-7304, ext. 211 or 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 National Institute for Rocket Propulsion Systems (NIRPS) supports the preservation and advancement of the nation's rocket propulsion industrial base to ensure that it continues to serve its vital role in national security, space exploration, economic growth, and education. The Institute stewards U.S. leadership in rocket propulsion by: collaborating and cooperating with the government, commercial and academic propulsion communities to most effectively use national capabilities and resources, monitoring public- and private-sector rocket propulsion activities to define and strengthen a healthy rocket propulsion industrial base, Facilitating technical solutions for today's challenges, evaluating and recommending new technologies for further development, and providing the information required by national decision-makers so that policies and other instruments of the government support the sustainment, and where appropriate, the advancement of the nation's civil, defense, and commercial propulsion capabilities.

NASA and the United States Air Force have made recent funding commitments in the area of green monopropellant technologies to accelerate testing of new propulsion designs, and ultimately qualifying them for use in flight applications. The purpose of this TIM is to bring the propulsion community (for example, experts on LMP-103S and AF-M315E) together to discuss current issues and where the community can go in the future. This forum will be conducive to sharing of ideas and the needs for future development which will lead to a NASA green propellant-focused roadmap to use in formulating funding decisions.

SCOPE

The scope of the Green Monopropellant Alternatives to Hydrazine TIM includes:

- I) Ground Operations, Production and Storage of Hydrazine
- II) Enabling Large Spacecraft Missions
- III) Enabling Small Spacecraft Missions
- IV) Commercial Spacecraft Advantages and Disadvantages
- V) International Participation
- VI) Long-term Storage, Handling and Transport
- VII) Ignition Techniques
- VIII) Stability and Performance
- IX) Materials Durability and Compatibility
- X) Propellant Mechanical Properties
- XI) Component Fabrication and Test
- XII) Decomposition and Reaction Modeling
- XIII) Qualifying New Source

MISSION AREAS/SPECIALIST SESSIONS

Only Session Areas noted in this Call for Presentations are included for the Green Monopropellant Alternatives to Hydrazine TIM as these are the areas for which the submittal of abstracts is particularly encouraged at this time.

AUTHOR TIMELINE

Date	Weeks before Meeting	Action
11-May	12	Extended deadline for receipt of abstracts.
20-May	11	Acceptance/rejection letters sent to authors.
3-Jun	9	Deadline for changes to meeting invitation and preliminary program.
10-Jun	8	Invitation, preliminary program, and registration materials forwarded to propulsion community.
8-Jul	4	Deadline for changes to Final Program
22-Jul	2	Deadline for receipt of presentation slides and clearance forms.
22-Jul	2	Deadline for receipt of registration certification forms.
4-Aug	0	JANNAF/NIRPS Green Monopropellant Alternatives to Hydrazine Technical Interchange Meeting

ABSTRACT SUBMITTAL PROCESS

- It is acceptable for this TIM to submit presentation slides only. An abstract is required for committee review.
- 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 Submittal Form](#) provided with this announcement on the [TIM website](#).
- Submit only unclassified abstracts. Abstracts will not be published and will only be used by the program committee members for presentation selection purposes.

- Obtain management approval on the [Abstract Submittal Form](#) to ensure availability of resources for your participation in the meeting.
- **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 CPIAC has been extended to Monday, **11 May 2015**.

CPIAC accepts only electronic submission of abstracts and presentations. Electronic abstracts are due at CPIAC by the extended deadline of Monday, **11 May 2015**. **Abstracts must be submitted on the [Abstract Submittal Form](#):**

- Via email to: scohen@cpiac.jhu.edu; (*Distribution A only*);
- **OR**
- Uploaded to CPIAC's secure server as follows:
 1. Go to <https://webdatabase.cpia.jhu.edu/docorg/program/cgi-bin/Login.pl>
 2. Choose Infobase: JANNAF Mtg Abstract Uploads
 3. Type in User Name: Abstract
 4. Type in Password [contact CPIAC (410) 992-7302 or 7300 for current password].
 5. Click the "Login" button.
 6. Click on "August 2015 Green Monopropellant Alternatives to Hydrazine TIM"; choose "Add Document" (to the left of the page)
 7. Complete the "Add Document" form, being sure to Title your Document, select "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".
 8. **Email scohen@cpiac.jhu.edu** to notify that the file has been successfully uploaded.

JANNAF/NIRPS GREEN MONOPROPELLANT ALTERNATIVES TO HYDRAZINE TIM SESSION AREAS

The TIM will cover these thirteen mission areas described below. Additional information concerning these areas or the topics being solicited should be directed to the respective Area Chair.

Mission Area I: Ground Operations, Production & Storage of Hydrazine

Chair: Mr. Joel W. Robinson, NASA-MSFC/Huntsville, AL
Telephone: (256) 544-3513
Email: joel.w.robinson@nasa.gov

This area focuses on the current state of hydrazine operations, production and storage. Anticipate presentations provided by the Kennedy Space Center, Vandenberg Air Force Base and the Defense Logistics Agency.

Mission Area II: Enabling Large Spacecraft Missions

Chair: Dr. Eric H. Cardiff, NASA-GSFC/Greenbelt, MD
Telephone: (301) 286-0388
Email: eric.h.cardiff@nasa.gov

This area focuses on exploring what future missions could be enabled utilizing green monopropellants. Anticipate a variety of presentations from manned spacecraft sizes down to small spacecraft (larger than ESPA class).

Mission Area III: Enabling Small Spacecraft Missions

Chair: Mr. Elwood F. Agasid, NASA-ARC/Moffett Field, CA
Telephone: (650) 604-0558
Email: elwood.f.agasid@nasa.gov

This area focuses on exploring what future small satellite missions could be enabled utilizing green monopropellants. Anticipate a variety of presentations from industry and academia.

Mission Area IV: Commercial Spacecraft Advantages & Disadvantages

Chair: Mr. Joel W. Robinson, NASA-MSFC/Huntsville, AL
Telephone: (256) 544-3513
Email: joel.w.robinson@nasa.gov

Input is desired from spacecraft prime manufacturers to understand advantages and disadvantages from their perspective of pursuit of a hydrazine replacement. Presentations may be provided by ATK, Ball, Boeing, Loral, Lockheed Martin, Northrop Grumman, Orbital Sciences and Sierra Nevada. These presentations will include industry's expectations for potential propellant conversion.

Mission Area V: International Participation (invited)

Chair: Mr. Joel W. Robinson, NASA-MSFC/Huntsville, AL
Telephone: (256) 544-3513
Email: joel.w.robinson@nasa.gov

Presentations from international efforts of hydrazine replacement. Presenters are expected from ECAPS, DLR, Astrium and ESA and will only be permitted for this section.

Mission Area VI: Long-term Storage, Handling and Transport

Chair: Mr. Adam J. Brand, AFRL/Edwards AFB, CA
Telephone: (661) 275-5787
Email: adam.brand@us.af.mil

Long-term depot or ground storage issues remain to be resolved to ensure flight readiness of propellants to include storage vessel and other environmental impacts. Document current level of hazard characterization and safety testing that has been performed on green monopropellants and what additional characterization and testing is required to accomplish standards for all domestic launch ranges.

Mission Area VII: Ignition Techniques

Chair: Mr. A. Paul Zuttarelli, AFRL/Edwards AFB, CA
Telephone: (661) 275-6786
Email: anthony.zuttarelli@us.af.mil

Hydrazine can be ignited at ambient conditions. What are the limitations of cold/warm start of green monopropellants and can they be overcome? Presentations will include discussion of current ignition concepts and future options that would minimize pre-heating of catalyst material or additional size, weight, and power demands from the spacecraft for propellant conditioning.

Mission Area VIII: Stability and Performance

Chair: Mr. Matthew C. Deans, NASA-GRC/Cleveland, OH
Telephone: (216) 433-6585
Email: matthew.c.deans-1@nasa.gov

This mission area will address current green monopropellant performance at various thruster levels and duty cycles. Of particular interest is the degradation and repeatability of minimum impulse bit as function of propellant throughput and start condition.

Mission Area IX: Materials Durability and Compatibility

Chair: Mr. Charles W. Pierce, NASA-MSFC/Huntsville, AL
Telephone: (256) 544-6366
Email: charles.pierce@nasa.gov

Due to the increased performance of green monopropellants, the intermediate decomposition products & their oxidation potential and the decomposition zonal temperatures that

thruster components will experience are elevated above typical hydrazine thruster component material capabilities. The more demanding propellant formulation and exhaust species environmental differences may require new material development to get thruster operational lifetimes and power requirements to match those of current hydrazine flight systems. For instance, how does the community address stress corrosion cracking? Can existing hydrazine components be utilized in green monopropellant service?

Mission Area X: Propellant Mechanical Properties

Chair: Ms. Caitlin A. Bacha, NASA-GSFC/Greenbelt, MD
Telephone: (301) 286-6217
Email: caitlin.bacha@nasa.gov

With the advent of these new propellants, what testing has been accomplished to obtain mechanical properties? Items of interest include capillary action, wetting, and surface tension which are of importance for liquid level sensing. For flow and sound propagation, density, viscosity and bulk modulus of the fluid are critical factors for future system performance calculations and design purposes.

Mission Area XI: Component Fabrication and Test

Chair: Mr. James A. Richard, NASA-MSFC/Huntsville, AL
Telephone: (256) 544-9452
Email: james.a.richard@nasa.gov

What is the current scale of green monopropellant components and systems & how/where are they tested? What is the change in physical infrastructure (either government or industry assets) to accommodate increased testing?

Mission Area XII: Decomposition & Reaction Modeling

Chair: Dr. Ghanshyam L. Vaghjiani, AFRL/Edwards AFB, CA
Telephone: (661) 275-5657
Email: ghanshyam.vaghjiani@us.af.mil

What are the exhaust products from green monopropellants and what are their impacts (if any) to spacecraft systems and/or payloads?

Mission Area XIII: Qualifying New Sources

Chair: Ms. Concepcion F. Allen, Air Force Petroleum Agency/Wright Patterson AFB, OH
Telephone: (937) 255-8038
Email: conchita.allen@wpafb.af.mil

How would the propulsion community qualify these new sources for propellant procurement? What are the standardized procedures for propellant acceptance and what is the status of standards / specifications for them?

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