



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
HEADQUARTERS
SPACE TECHNOLOGY MISSION DIRECTORATE
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**GAME CHANGING DEVELOPMENT PROGRAM,
THIN-PLY COMPOSITES FOR SPACE EXPLORATION
APPLICATIONS – REQUEST FOR INFORMATION**

Number NNH15ZOA007L

Request for Information Issued: *June 25, 2015*

Request for Information Due: ***August 6, 2015 (5:00pm Eastern)***

Catalog of Federal Domestic Assistance (CFDA) Number 43.012

OMB Approval Number 2700-0087

Thin-Ply Composites for Space Exploration Applications

Responders are reminded:

REQUEST FOR INFORMATION (RFI): THIS IS *NOT* A REQUEST FOR PROPOSAL, QUOTATION, OR INVITATION TO BID NOTICE.

1.0 Introduction

The National Aeronautics and Space Administration (NASA) is continually looking for ways to help advance the development of commercial space products and services. With the recent influx of U.S. private-sector companies interested in space exploration and utilization, NASA is seeking to better understand outside interest in a myriad of exploration activities. One such activity of interest is the development of low mass structures. As NASA evolves its plans to send humans deeper into space than ever before and continues to advance its capabilities to perform space-based science, there will be a continual need to reduce the mass and increase the performance of the structural systems used for space exploration activities. NASA's Space Technology Mission Directorate (STMD) is considering development efforts to enable an increase in the use of fiber-reinforced polymeric composite materials through technology investments at multiple Technology Readiness Levels (TRL) levels. Recent investments have ranged from the design and fabrication of a large (5-m diameter) composite cryogenic propellant storage tank using out-of-autoclave fabrication methods to the development of structural carbon nanotube composites. NASA is also developing extremely large (8.4m diameter) composite structures that could be used on future upgrades of the Space Launch System.

The use of thin-ply composites is one area of composites technology that has not yet been fully explored or exploited by NASA. For the purposes of this Request for Information (RFI), thin-ply composites are those with cured ply thicknesses ranging from 0.0025" to 0.001" or less. By comparison, a standard-ply-thickness composite would have a cured ply thickness of approximately 0.0055". The variants at the lower end of this range are herein referred to as an ultra-thin-ply composite. Thin-ply composites hold the potential for reducing structural mass and increasing performance due to their unique structural characteristics, which include (when compared to standard-ply-thickness composites):

1. Improved damage tolerance
2. Resistance to microcracking (including cryogenic-effects)
3. Improved aging and fatigue resistance
4. Reduced minimum-gage thickness
5. Increased scalability

These characteristics can make thin-ply composites attractive for a number of space applications. For example, the resistance to microcracking makes thin-ply composites an excellent candidate for a deep-space habitation structure where hermeticity is critical. Additionally, since a deep-space habitat may need to be pre-positioned in space for a long

period of time prior to crew arrival, the enhanced aging and fatigue resistance and resistance to cryogenic-induced microcracking will also be a benefit. Finally, since the designs of these types of pressurized structures are typically constrained by minimum gage considerations, the ability to reduce that minimum gage thickness offers the potential for significant mass reductions. For these reasons, NASA is interested in exploring the use of thin-ply or ultra-thin-ply composites by focusing on an application to a deep-space habitation structure. NASA recognizes that there are also a number of commercial space and terrestrial applications that may be enhanced by this technology. As such, NASA's STMD is seeking input through this RFI on experiences within industry, academia, and other government agencies on the development of thin-ply composites technology that would support future commercial and NASA space missions while also supporting terrestrial applications.

2.0 Development Approach

A potential partnership is of interest to allow for the most efficient use of resources in the development and utilization of thin-ply composite technology in future space exploration applications. The envisioned activity would include an initial evaluation of the performance of a range of aerospace-grade thin-ply composites prior to the development effort focused on a deep-space habitation structure. The envisioned partnerships would:

- Transfer and capitalize on a long history of NASA investments in space technologies and expertise.
- Explore improvements to the manufacturing of thin-ply and ultra-thin-ply composites with space-qualified material systems.
- Develop an improved understanding of the unique structural characteristics of thin-ply and ultra-thin-ply composites and how these characteristics can be reliably exploited in the Design Development Test and Evaluation (DDT&E) process.
- Explore the applicability of thin-ply and ultra-thin-ply composites structures to commercial and NASA space applications and terrestrial applications.

Potential NASA contributions to a partnership could include:

- **Technical Expertise:** NASA envisions that an integrated team comprised of NASA civil servants and industry partner personnel could work together to manufacture, evaluate, design, develop, and test ultra-thin-ply composites structures for a deep-space habitat structure.
- **Test Facilities:** NASA can provide industry partners, at no cost, access to testing facilities such as automated fiber placement machines, material characterization, environmental and mechanical test labs, etc., as available.

- **Hardware and Software:** NASA may be able to contribute specific hardware and software elements for the development and testing of ultra-thin-ply composite structures and the development of damage analysis for thin-ply composites.

The type of agreement to be employed for this partnership is to be determined, but options include a Space Act Agreement (SAA), Cooperative Research and Development Agreement (CRADA), or other (ref. NASA Policy Directive (NPD) 1050.11, *15 USC §3710a(d)(1)*).

3.0 Information Requested

The responses to this RFI should include the following information:

- **Respondent's Information:** Company name and address, point-of-contact name, e-mail address, and phone number.
- **Technology Description:** Provide a detailed description of the respondent's experience with and interest in using thin-ply and ultra-thin-ply composites technology in its products (including previous research and development efforts and previous funding sources). Describe the potential applications and the expected benefits relative to standard composites technology.
- **Technology Readiness Level:** Identify the TRL including sufficient data / information to support the assessment (See URL for TRL definitions:
http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_7123_001B_&page_name=AppendixE&search_term=7123.1b
- **Development Approach:** Describe the suggested approach to mature the technology to the point where the technology can be qualified and marketed with no further government investments. Identify the failure modes that may be improved through the use of thin-ply composites and the test data required to demonstrate the improvements and why these failure modes are important to applications that will drive development of thin-ply composites.
- **Feasibility of a partnership:** Is cooperation with NASA feasible? What type of arrangement and agreement with NASA are desired and why? Identify any particular considerations, circumstances, or issues that would need to be addressed in an agreement. For example, what are your expectations regarding the allocation of intellectual property rights?
- **Potential Contributions:** List potential contributions by the respondent that would complement the possible NASA contributions outlined above. List the expertise and support (including both labor and facilities) desired from NASA (if any).
- **Market Potential Assessment:** Discuss the commercial market for the technology once the development project is completed, including potential customers and the expected market size. Detail how this technology has the potential to significantly change the

commercial market space. The assessment should include the potential need for the technology by industry, NASA, and other government agencies.

4.0 RFI Questions

If you have questions concerning this RFI prior to submitting a response, please send your questions to stmdgcdrfi@nasaprs.com and reference NNH15ZOA007L. NASA will review the questions and post a response in the Frequently Asked Questions (FAQs) document that will be posted on the RFI Website in NSPIRES. Questions must be submitted by July 31, 2015 to be considered by NASA for a response.

5.0 Submitting Responses

Responses to the Game Changing Development Program, Thin-Ply Composites for Space Exploration Applications RFI (NNH15ZOA007L) must be submitted electronically using the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at <http://nspires.nasaprs.com/>. It is important to note that some of the functionality of the NSPIRES system uses terminology that does not exactly track to the collection of RFI data. For instance, when submitting responses to this RFI, submitters will be prompted to “Access ‘Proposals/NOIs’ in the NSPIRES Options Page.” Use of the term “proposals” and “notices of intent” in these instructions does not mean that NASA is inviting proposals or offers in response to this RFI.

Responses are limited to no more than 8 pages and should be uploaded as a single PDF file attachment not to exceed 10MB at the NSPIRES web site (<http://nspires.nasaprs.com>). The information provided in response to this RFI will not be disclosed publicly or used outside of the government for any purposes. The target audience of responders is primarily commercial entities as potential NASA and other government responses are regularly captured through collaborations.

NSPIRES Account Registration

All respondents are required to register with NSPIRES and are urged to access this site well in advance of the RFI due date to familiarize themselves with its structure and enter the requested identifier information. This data site is secure and all information entered is strictly for NASA use only. Respondents do not have to affiliate with an organization during registration to submit an RFI. Respondents will submit the RFI directly and do not have to have an authorized organizational representative submit on their behalf. To register for an account, go to: <http://nspires.nasaprs.com/external/> and click on “Getting an Account” on the left hand margin of the screen.

Creating Your RFI Response

Responses must be submitted using the “Notice of Intent (NOI)” module within the NSPIRES system. To initiate an RFI response:

- Log in using your NSPIRES user name and password
(<http://nspires.nasaprs.com/external/>)
- Access “Proposals/NOIs” in the NSPIRES Options Page.
- Click on the “Create NOI” button on the right side of the screen. Select the “NASA Request for Information Game Changing Development Program: Thin-Ply Composites for Space Exploration Applications (NNH15ZOA007L).
- Follow the step-by-step instructions provided in NSPIRES to complete your RFI. The following two elements are mandatory for this RFI submission:
 - o Utilize the “Summary” element of the RFI to provide a concise paragraph summarizing your response to this RFI (limited to 4,000 characters).
 - o Utilize the “Program Specific Data” element to respond to the series of specific questions (each text question response is limited to 4,000 characters).

Requests for assistance in accessing and/or using the NSPIRES website should be submitted by e-mail to nspires-help@nasaprs.com or by telephone to (202) 479-9376 Monday through Friday, 8:00 AM – 6:00 PM Eastern Time. FAQs on NSPIRES may be accessed through the Proposal Online Help site at <http://nspires.nasaprs.com/external/help.do>. Tutorials of NSPIRES are available at <http://nspires.nasaprs.com/tutorials/index.html>.

The information is requested for planning purposes only, subject to Federal Acquisition Regulation (FAR) Clause 52.215-3, entitled "Solicitation for Information for Planning Purposes." Provided the availability of funds, the Space Technology Mission Directorate will consider a competitive Broad Area Announcement (BAA) in one or more such topic areas. However, the release of this RFI does not indicate that the government will issue a solicitation in this area nor does it obligate the government to invest any resources specific to the targeted technology area.