NASA SBIR 2015 Phase I Solicitation

Z2.01 Large-Scale Polymer Matrix Composite (PMC) Structures, Materials, and Manufacturing Processes

Lead Center: MSFC

Participating Center(s): LaRC

The subtopic area for Large-Scale Polymer Matrix Composite (PMC) Structures and Materials concentrates on developing lightweight structures, using advanced materials technologies and new manufacturing processes. The objective of the subtopic is to advance technology readiness levels of PMC materials and manufacturing for launch vehicles and in-space applications resulting in structures having affordable, reliable, and predictable performance. A key to better understanding predictable performance and faster qualification of components includes integrating the analytical tools between the materials and manufacturing process.Â

The subtopic will focus efforts to enable large (5 to 9 meter) diameter composite structures. Specific areas of interest include advances in PMC high performing resin/fiber material systems and associated out-of-autoclave processes for the manufacturing of large composite structures and innovative low cost, high reliability composite joint concepts/techniques. Proposals to each area will be considered separately:Â

- Advances in PMC high performing resin/fiber systems which can be cured via out of autoclave processes (such as resin infusion, or equivalent) which will yield large complex composite structures. Properties for this material system should use IM7/8552-1 or IM7/977-2 toughened epoxy systems as a baseline goal. Acceptable properties are key, but end-to-end manufacturing process evaluation should be considered to support scale-up including integration of modeling and potential automation of the processes.
- Innovative low cost, high reliability composite joining concepts/techniques for attaching large segmented structures together. Concepts must consider end-to-end process evaluation with considerations to modeling of the joint/joining process and to full-size scale-up factors which will limit autoclave and oven access for joint cures. Concepts that are amenable to in-situ and/or on-orbit implementation are also of interest.

Research should be conducted to demonstrate novel approaches, technical feasibility, and basic performance characterization for large-scale PMC structures and joint concepts during Phase I, and show a path toward a Phase II design allowables and prototype demonstration. Emphasis should be on demonstrable manufacturing technology that can be scaled up for very large structures.Â

References:

- Kirsch, M. T., â€œComposite Crew Module: Primary Structure.â€ (http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110020665.pdf).
- Tenney, D. R. et al., â€œNASA Composite Materials Development: Lessons Learned and Future Challenges,â€ (http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20090037429.pdf).

- â€œComposite Cryotank Technologies & Demonstration.â€ (https://gcd.larc.nasa.gov/wp-content/uploads/2013/07/FS_CCTD_factsheet.pdf).