

EM42 Notice of Intent to Participate in SMD Technology Showcase

11/29/2022

ASTROLAB, Lunar Geophysical Network, Mars Icebreaker and Mars PLACER Net missions propose use of various types of vehicles – such as rovers, landers and flying probes - to accomplish their scientific objectives. Although designs for such vehicles are myriad, many structural components can be made using composite manufacturing technologies. Composite materials are also myriad, by nature, but carbon fiber reinforced polymers (CFRP) in particular are sought after for their high specific strength and specific stiffness. CFRP components could be especially beneficial in vehicle designs for Moon or Mars missions due to their nearly negligible coefficient of thermal expansion (CTE). CTE is a critical design characteristics in environments where significant thermal swings are prevalent, such as those of atmosphere-less Moon and Mars.

MSFC/EM42 houses several relevant composites technologies. Strong and rigid struts can be filament-wound. Shells and platforms can be laid-up using automated fiber placement (for repeatability) or by hand (for small features). Monolithic structures can even be designed to reduce part count and therefore reduce the risk of joint failures. Composites are also tailorable, allowing the incorporation of different material types or formats through the thickness of a part. This includes materials which shield from radiation or electrostatic discharge. Finally, the rigidity of composite parts minimizes overall vibration and compliance within a design.

Additionally, missions such as Triton Ocean World Surveyor anticipate use of traditional, metallic fuel tanks. Composite overwrapped pressure vessels (COPVs) are suitable for use in this application as well. The Triton mission even cites a concern for heat retention, for which CFRP also offers improved characteristics over traditional metallic tanks.