

Thermal Protection System Application to Composite Cryotank Technology Demonstrator

Project Manager(s)/Lead(s)

Alison Protz/EM41
(256) 544-4234

Mindy Nettles/XP50
(256) 544-1569

Sponsoring Program(s)

Human Exploration and Operations Mission Directorate
Space Launch System Advanced Development

Project Description

The EM41 Thermal Protection System (TPS) team contributed to the success of the Composite Cryotank Technology Demonstrator (CCTD) manufacturing by developing and implementing a low-cost solution to apply cryoinsulation foam on the exterior surface of the tank in the NASA Marshall Space Flight Center (MSFC) TPS Development Facility, Bldg. 4765. The TPS team used techniques developed for the small-scale composite cryotank to apply Stepanfoam S-180 polyurethane foam to the 5.5-m CCTD using a manual spray process. Manual spray foam technicians utilized lifts and scaffolding to access the barrel and dome sections of the large-scale tank in the horizontal orientation. During manufacturing, the tank was then oriented vertically, allowing access to the final barrel section for manual spray foam application. The CCTD was the largest application of manual spray foam performed to date with the S-180 polyurethane foam and required the TPS team to employ best practices for process controls on the development article.



5.5-m-diameter CCTD in vertical orientation following completion of foam application.



Manual spray foam application to barrel section of the CCTD.



CCTD in-transit on TPS transporter—foam application is complete on domes and main barrel section.

Anticipated Benefits

Following cryoinsulation foam application, the CCTD was subjected to cryogenic testing at the MSFC test area. This testing demonstrated successful foam adhesion to a composite substrate and successful performance of S-180 foam when applied manually to a large-scale tank.

Potential Applications

Manual spray foam application processes demonstrated on the CCTD can be further developed to extend to other large-scale manual spray foam applications for composite or metal cryotanks for future potential applications including composite vessels, in-space storage tanks, and launch vehicle cryotanks.

Notable Accomplishments

The TPS team worked closely with the CCTD team to reduce total schedule and cost for the project by using TPS best practices and creatively rearranging the TPS processing order for the domes and barrel to reduce scaffolding setup times and fees. The TPS team provided solution options to the CCTD project team and appropriately documented concurrence and accepted risks to progress the CCTD through the TPS application process. This was the largest manual spray application performed to date for a cryogenic vessel and was the largest composite cryotank manufactured to date that required cryoinsulation foam.