

Utilization of Micro Tube Heat Exchanger for Next Generation Phase Change Material Heat Exchanger Development

Low Lunar orbit presents a unique thermal environment with high planetary and high solar IR requirements. Orion requires a phase change material heat exchanger (PCM HX) to act as a supplemental heat rejection device (SHReD) during this orbit. As a result, Orion currently uses a PCMHX to meet heat rejection demands in low lunar orbit. This PCM HX weighs 145 lbs, a significant amount of weight on the Crew Module Adaptor. To reduce this weight, a new PCM HX and phase change material is being proposed. This new PCM HX, constructed by Mezzo technologies, was originally designed as a water based PCM HX but is now be repurposed for phase change materials with transition temperatures in Orion's set points and different freeze front propagations. Mezzo's PCM HX utilizes micro tubes which greatly increase the overall heat transfer efficiency allowing for a compact design and significant weight savings. A new phase change material is also being proposed which has a higher latent heat of fusion as well as a higher density. This paper investigates the design, testing, and analysis done on the new Mezzo PCM HX as well as the corresponding phase change material.