

# Overview of NASA's Thermal Control Technology Development Project

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NASA's Constellation Program included the Orion, Altair, and Lunar Surface Systems project offices. The first two elements, Orion and Altair, were planned to be manned space vehicles while the third element was much broader and included several sub-elements including Rovers and a Lunar Habitat. The planned missions involving these systems and vehicles included several risks and design challenges. Due to the unique thermal operating environment, many of these risks and challenges were associated with the vehicles' thermal control system. NASA's Exploration Technology Development Program (ETDP) consisted of several technology development projects. The project chartered with mitigating the aforementioned thermal risks and design challenges was the Thermal Control System Development for Exploration Project. These risks and design challenges were being addressed through a rigorous technology development process that was planned to culminate with an integrated thermal control system test. Although these Constellation elements have been cancelled or significantly changed, the thermal technology development process is being continued within a new program entitled Enabling Technology Development and Demonstration (ETDD). The current paper summarizes the development efforts being performed by the technology development project. The development efforts involve heat acquisition and heat rejection hardware including radiators, heat exchangers, and evaporators. The project has also been developing advanced phase change material heat sinks and performing a material compatibility assessment for a promising thermal control system working fluid. The to-date progress and lessons-learned from these development efforts will be discussed throughout the paper.

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