Abstract Submittal Form

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Unclassified Abstract (250 – 300 words; do not include figures or tables)

* A liquid oxygen / liquid methane 2,000 lbf thruster was designed and tested in conjuction with a nozzle heat exchanger for cold helium pressurization. Cold helium pressurization systems offer significant spacecraft vehicle dry mass savings since the pressurant tank size can be reduced as the pressurant density is increased. A heat exchanger can be incorporated into the main engine design to provide expansion of the pressurant supply to the propellant tanks. In order to study the systems integration of a cold-helium pressurization system, a 2,000 lbf thruster with a nozzle heat exchanger was designed for integration into the Project Morpheus vehicle at NASA Johnson Space Center. The testing goals were to demonstrate helium loading and initial conditioning to low temperatures, high-pressure/low temperature storage, expansion through the main engine heat exchanger, and propellant tank injection/pressurization. The helium pressurant tank was an existing 19 inch diameter composite-overwrap tank, and the targert conditions were 4500 psi and -250 degF, providing a 2:1 density advantage compared to room tempatrue storage. The thruster design uses like-on-like doublets in the injector pattern largely based on Project Morpheus main engine hertiage data, and the combustion chamber was designed for an ablative chamber. The heat exchanger was installed at the ablative nozzle exit plane. Stand-alone engine testing was conducted at NASA Stennis Space Center, including copper heat-sink chambers and highly-instrumented spool-pieces in order to study engine performance, stability, and wall heat flux. A one-dimensional thermal model of the integrated system was completed. System integration into the Project Morpheus vehicle is complete, and systems demonstrations will follow.

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