Multi-Mission Earth Entry Vehicle
Design Trade Space and Concept Development Status

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ABSTRACT

The Multi-Mission Earth Entry Vehicle (MMEEV) concept, based on the Mars Sample Return (MSR) EEV design and first introduced at IPPW6, is a flexible design concept which can be optimized or tailored by any sample return mission, including lunar, asteroid, comet, and planetary (including Mars), to meet that mission's specific requirements. By leveraging common design elements, this approach could significantly reduce the risk and associated cost in development across all sample return missions, while also providing significant feed-forward risk reduction in the form of technology development, testing, and even flight experience, for an eventual MSR implementation.

This presentation will describe the current status of the MMEEV concept development, now directed as part of the In-Space Propulsion Technology (ISPT) Program. The current MMEEV parametric configuration and mass model, developed for a range of vehicle parameters, including vehicle diameter and payload mass/size, is presented. Engineering estimates of MMEEV vehicle and trajectory performance are generated using the NASA Langley Research Center's Program to Optimize Simulated Trajectories (POST2) 6-DOF simulation software. Fully integrated with POST2 are MMEEV specific models, including vehicle mass properties, aerodynamics, aerothermodynamics, TPS thickness, and simplified 1-D impact analysis. Preliminary estimates for heat rates, heat loads, impact environments, and other vehicle and trajectory performance characteristics are provided across the MMEEV design trade space, which includes vehicle configuration and payload considerations, as well as a broad range of likely sample return mission entry conditions (e.g. entry velocity and entry flight path angle).

Future plans for continued MMEEV development, both near and long-term, are also discussed. These include the next steps in development of vehicle mass and impact models, as well as plans for integration of the MMEEV multi-discipline analysis into an Entry Descent and Landing Quicklook tool, originally developed under ISPT for utilization on aerocapture mission studies.