MSL Entry, Descent, and Landing Instrumentation: Return on Investment

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Introduction: On Aug 5, 2012 the Mars Science Laboratory (MSL) Entry, Descent, and Landing Instrumentation (MEDLI) suite on MSL entry vehicle heatshield successfully returned surface pressure and in-depth temperature data.[1-3] The MEDLI data has given scientists and engineers an unprecedented ability to reconstruct entry environment, atmospheric density, and flight trajectory, and flight validation of predictions vehicle aerodynamics and thermal protection system (TPS) performance. This presentation will discuss key findings from MEDLI, some of which are being applied to improve definition of aerothermal environment and TPS sizing margins for existing NASA entry missions. The postflight analysis has shown that a significant thermal protection mass saving upon redesign is possible for an MSL-class vehicle. The success of MEDLI has also demonstrated and qualified robust flight instrumentation technologies at very low risk to the mission. The potential benefits of MEDLI to planetary exploration and sample return missions, as well as to exploration class missions to Mars will be presented.

MEDLI2 Instrumentation Suite

The presentation will also introduce an enhanced MEDLI instrumentation suite (called MEDLI2) that is being developed for Mars-2020 mission with the goals of further reducing TPS mass fraction, and enhancing atmosphere and trajectory reconstruction.

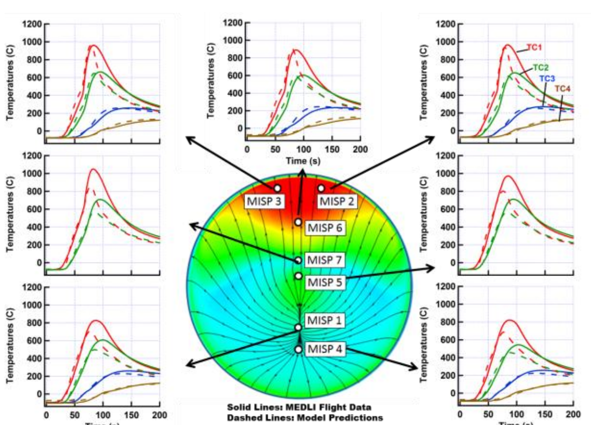

Figure 1. MEDLI temperature data and comparisons with model predctions

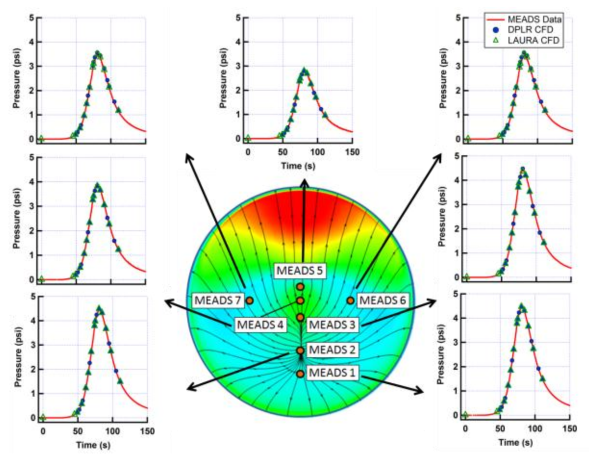

Figure 2. MEDLI pressure data and comparisons with model predctions

Mars-2020 will utilize an MSL build-to-print aeroshell system that will deploy a surface rover similar to *Curiosity* on Mars. This presentation will describe MEDLI2 objectives, scope, and instrumentation suite being developed. MEDLI2 will expand on the data acquired by the MEDLI instrumentation suite. The scope of MEDLI2 will include instrumentation on the backshell, where current aerothermal and pressure environment predictions are highly uncertain. A significant mass savings in the backshell for future missions is anticipated with supporting data from MEDLI2. In addition, MEDLI2 will include pressure measurements in the supersonic flight regime, to better reconstruct the flight trajectory and validate aerodynamic predictions. The current aerodynamic prediction uncertainty in supersonic flight contribute to an increased landing footprint.

References:

[1] Munk, M., Little, A., Kuhl, C., Bose, D., and Santos, J., (2013) *AAS 13-310* [2] Bose, D., White, T, Mahzari, M., and Edquist, K., (2013) *AAS 13-311*. [3] Karlgaard, C.D., Kutty, P., Schoenenberger, M, and Schidner, J., *AAS 13-307*.