MELDI2 DO NO HARM TEST SERIES. G. T. Swanson[1], J. A. Santos[2], T. R. White[3], W. E. Bruce[4], C. A. Kuhl[4] and H. S. Wright[4], [1]AMA Incorporated, NASA Ames Research Center, Moffett Field, CA 94035 USA, g.swanson@nasa.gov, [2]Sierra Lobo, NASA Ames Research Center, [3]NASA Ames Research Center, [4]NASA Langley Research Center

Abstract: Mars 2020 will fly the Mars Entry, Descent, and Landing Instrumentation II (MEDLI2) sensor suite consisting of a total of seventeen instrumented thermal sensor plugs, eight pressure transducers, two heat flux sensors, and one radiometer embedded in the thermal protection system (TPS). Of the MEDLI2 instrumentation, eleven instrumented thermal plugs and seven pressure transducers will be installed on the heatshield of the Mars 2020 vehicle while the rest will be installed on the backshell. The goal of the MEDLI2 instrumentation is to directly inform the large performance uncertainties that contribute to the design and validation of a Mars entry system. A better understanding of the entry environment and TPS performance could lead to reduced design margins enabling a greater payload mass-fraction and smaller landing ellipses.

To prove that the MEDLI2 system will not degrade the performance of the Mars 2020 TPS, an Aerothermal Do No Harm (DNH) test series was designed and conducted. Like Mars 2020's predecessor, Mars Science Laboratory (MSL), the heatshield material will be Phenolic Impregnated Carbon Ablator (PICA); the Mars 2020 entry conditions are enveloped by the MSL design environments, therefore the development and qualification testing performed during MEDLI is sufficient to show that the similar MEDLI2 heatshield instrumentation will not degrade PICA performance. However, given that MEDLI did not include any backshell instrumentation, the MEDLI2 team was required to design and execute a DNH test series utilizing the backshell TPS material (SLA-561V) with the intended flight sensor suite.

To meet the requirements handed down from Mars 2020, the MEDLI2 DNH test series emphasized the interaction between the MEDLI2 sensors and sensing locations with the surrounding backshell TPS and substrucutre. These interactions were characterized by performing environmental testing of four 12" by 12" test panels, which mimicked the construction of the backshell TPS and the integration of the MEDLI2 sensors as seen in Figure 1. The testing included thermal vacuum/cycling, random vibration, shock, and arc jet testing. The test panels were fabricated by Lockheed Martin, establishing techniques that will be utilized during the Mars 2020 vehicle installation. Each test panel included one thermal sensor plug (two embedded thermocouples), one heat flux sensor, and multiple pressure port holes for evaluation.

This presentation will discuss the planning and execution of the MEDLI2 DNH test series. Selected highlights and results of each environmental test will be presented, and lessons learned will be addressed that will feed forward into the planning for the MEDLI2 flight system certification testing.

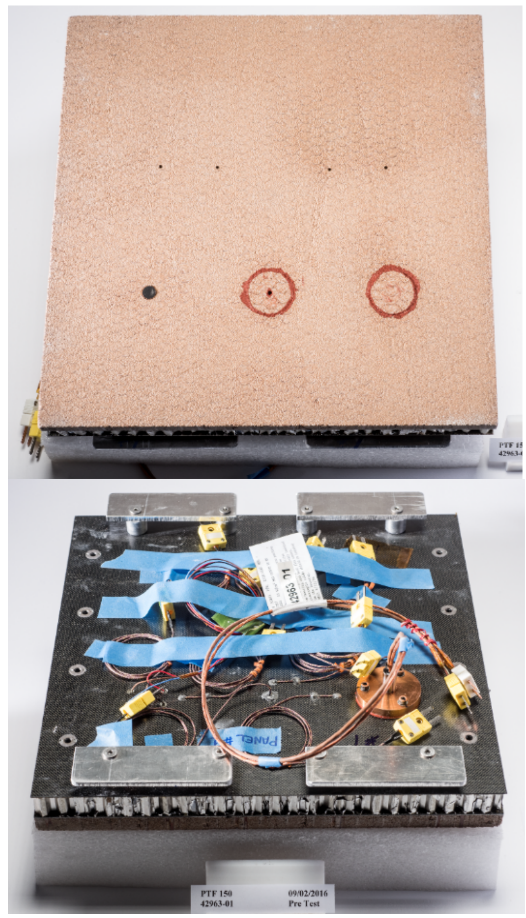

Figure 1. Front (top) and Backside (bottom) of the MEDLI2 DNH Test Panel