

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

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DESIGN, DEVELOPMENT AND QUALIFICATION OF A GAS BASED DUST REMOVAL TOOL
FOR MARS EXPLORATION MISSIONS

Abstract

Current Mars science goals require the removal of dust from the surface of samples to expose the rock beneath the oxidized dust layer for imaging. A cold gas system comprised of a supply tank of gas, a plenum tank, some solenoid control valves, and a small nozzle is proposed to fill this need. This paper shall summarize results from an extensive development test program conducted at Mars-like conditions to investigate the performance drivers of such a system. Over 400 tests were conducted at Martian pressure to explore the effect of the working gas mass flow rate, molecular weight, plenum size, ambient back pressure, nozzle design, pulsed operation, and nozzle height above the surface on dust suspension and entrainment. The results of this testing have been used to inform a design for flight. This design has now been baselined to fly on the Mars 2020 rover. An overview of the design shall be provided along with a discussion of the challenges that have been overcome in order to implement this tool for flight. This includes a discussion of the challenges of designing a system that can withstand temperatures as low as -135 C, the subsequent selection of materials for this application, and thermal cycling test results of candidate solenoid valves.