

Title: Ensuring Each Breath: An Oxygen Compatible Flowmeter for the Exploration PLSS

The portable life support system (PLSS) of the exploration extravehicular mobility unit (xEMU) provides the necessary environment for a crew member to operate within the space suit. Within the PLSS, the oxygen ventilation loop provides carbon dioxide washout, gas temperature control, humidity control, and trace contaminant removal. Historically, there have been issues with the measurement of air flow for the oxygen ventilation loop. With the Apollo EMU, there were humidity issues with the implemented flow meter. For the Space Shuttle/ISS EMU, the flow sensor was a flapper/microswitch combination that only measured a discrete threshold for flow. The proposed innovation allows for continuous air flow measurement from 1 to 8 acfm with static pressures of 3.5 to 25 psia in the pure oxygen environment. This new method meets the low pressure drop requirement (< 0.68 inH₂O) and allows operation beyond low earth orbit (LEO) with radiation hardened electronics. This presentation reports the results of the benchtop prototype, which demonstrated accuracies of less than 1.5% across all expected flow regimes, laminar, transition, and turbulent.