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Simulation of gas and water management strategies in PEM fuel cells for UAV power NASIR WADE, SONYA SMITH, Howard University — Proton exchange membrane fuel cells (PEMFC) a involve a number of complex fluid phenomena that are not well understood. The focus of this research is to design a fuel cell that addresses the issues of gas and water management for the power requirements for an Unmanned Arial Vehicle (UAV). Often in conventional stack design, PEM fuel cells are connected electrically in series to create the desired voltage and feed from a common fuel or oxidant stream. This method of fueling, often leads to an uneven distribution of fluid within the stack, causing issues such as cell flooding, dehydration of membrane and inevitably poor fuel cell performance. Generally, fuel cell designers and developers incorporate higher stoichiometric gas flow rates and use flow field designs with high pressure drops in order to counter this phenomenon, ensuring even gas distribution. This method, although effective for water removal, leads to added cost and higher levels of wasted fuel. Using a simulation based approach we demonstrate the feasibility and effectiveness of an individual fuel and oxidant flow distribution, integrated with an individual sequential exhaust technique for a 6-8 cell stack which outputs 300-500 Watts of power. Using varied exhaust configurations the most optimal active gas management strategy will be outlined and recommended to give the best stack performance.

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