Lightweight High Efficiency Electric Motors for Space Applications

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Abstract. Lightweight high efficiency electric motors are needed across a wide range of space applications from - thrust vector actuator control for launch and flight applications to – general vehicle, base camp habitat and experiment control for various mechanisms to - robotics for various stationary and mobile space exploration missions. QM Power's Parallel Path Magnetic Technology Motors have slowly proven themselves to be a leading motor technology in this area; winning a NASA Phase II for "Lightweight High Efficiency Electric Motors and Actuators for Low Temperature Mobility and Robotics Applications," a US Army Phase II SBIR for "Improved Robot Actuator Motors for Medical Applications", an NSF Phase II SBIR for "Novel Low-Cost Electric Motors for Variable Speed Applications" and a DOE SBIR Phase I for "High Efficiency Commercial Refrigeration Motors." Parallel Path Magnetic Technology obtains the benefits of using permanent magnets while minimizing the historical trade-offs/limitations found in conventional permanent magnet designs. The resulting devices are smaller, lower weight, lower cost and have higher efficiency than competitive permanent magnet and non-permanent magnet designs. QM Power's motors have been extensively tested and successfully validated by multiple commercial and aerospace customers and partners as Boeing Research and Technology. Prototypes have been made between 0.1 and 10 HP. They are also in the process of scaling motors to over 100kW with their development partners. In this paper, Parallel Path Magnetic Technology Motors will be discussed; specifically addressing their higher efficiency, higher power density, lighter weight, smaller physical size, higher low end torque, wider power zone, cooler temperatures, and greater reliability with lower cost and significant environment benefit for the same peak output power compared to typically motors. A further discussion on the inherent redundancy of these motors for space applications will be provided.