

Exceptional Engineering Achievement Medal



Patricia M. O'Donnell

For outstanding engineering achievements which resulted in higher performance and a breakthrough cycle life of nickel-hydrogen batteries. These achievements are impacting major NASA space missions.

Dr. Patricia O'Donnell's exceptional engineering achievements in advanced battery technology have had major impacts on current and future NASA missions, namely Space Telescope and Space Station Freedom. Until she addressed and determined solutions to performance and life cycle problems, the high specific energy potential of Hydrogen (Ni-H₂) Battery System could not be used for many space missions. Although battery systems had been under development for more than a decade, the performance of Ni-H₂ cells had been disappointing.

Dr. O'Donnell combined her broad technical background in electrochemical systems with a thorough analysis of the state-of-the-art Ni-H₂ cell to determine what changes were needed to make these cells useful for a broad spectrum of space missions. Her investigation determined that the solution lay in controlling the distribution of pores in the nickel electrodes. As a result of Dr. O'Donnell's pioneering pore-size engineering work, nickel electrode pore-size engineering techniques have been incorporated into the manufacturing methods of Ni-H₂ batteries.

Her fine engineering insight also helped her find a way to achieve a remarkable ten-fold increase in the life cycle of Ni-H₂ batteries. This breakthrough came after her investigation determined that the expansion of the nickel electrodes during charging and discharging results in a shorter life. The solution Dr. O'Donnell identified was to decrease the concentration of the electrolyte used in the batteries. This change has significantly extended the life cycle of the batteries.

A Ni-H₂ battery that includes Dr. O'Donnell's improvements is currently providing high performance aboard the Hubble Space Telescope. Two other missions that may benefit from Dr. O'Donnell's advancements in Ni-H₂ batteries to lower battery mass and extend life are the Earth Observing System (EOS) and the Advanced Tracking and Data Relay Satellite (Advanced TDRSS).

For Space Station Freedom, a tentative plan to reduce mass by halving the number of batteries onboard depends directly on the ability to maintain high, stable Ni-H₂ battery performance at very high depths of discharge for extremely high numbers of cycles. This combination, which had long been considered impossible, is now attainable as a result of Dr. O'Donnell's engineering achievements.