Managing Revolutionary Research

Revolutionary research – research that goes beyond extrapolations of known technology – presents unique management challenges. In addition to prioritizations and resource allocation, revolutionary research adds the difficulty of distinguishing potentially breakthrough research from fringe research, and then the challenge of converting long-range prospects into near-term progress. The lessons from NASA's "Breakthrough Propulsion Physics Project" are described. This project investigated 'gravity control' and 'faster-than-light' travel, notions that are on the edge of emerging knowledge and vulnerable to sensationalistic expectations. Using methods designed to combine *vision* (for extending beyond established knowledge) with the rigor (for making genuine progress), this project assessed 10 different research approaches, produced 16 peer-reviewed journal articles, an award-winning website, and garnered several positive press stories for NASA (including the cover of *Popular Science*, May 2001) all for a total cost of $1.6 M spread over 1996 to 2002. The principles of this NASA project include; reliability of knowledge, immediacy, measured progress, diversified portfolio, impartial reviews, empiricism, and publishing all findings. For context, more general historic lessons about revolutionary research are discussed and then converted into specific advice for managers. It is hoped that by articulating the specific challenges and mitigation strategies, that other leading-edge research projects can improve their prospects for success.

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Marc Millis is NASA's leading expert on such visionary goals as *gravity control, space drives, and faster-than-light* travel. He received his bachelor's degree in physics from Georgia Tech in 1982 and a Masters in physics-entrepreneurship from Case Western Reserve University in 2006. Millis is also an alumnus of the *International Space University Summer Session* (1998). From 1996 through 2002 he managed NASA's Breakthrough Propulsion Physics Project that published its progress in over a dozen journal articles. This work gained wide public attention, being cited in *Newsweek, Wired, Popular Science* (May 2001 cover story), *New York Times* and in the books *Centauri Dreams* (Gilster 2004) and in *I'm Working On* That (Shatner & Walter 2002). This work also earned Millis a nomination for a 2004 World Technology Award. With the help of collaborators, he continues pursuing this topic on his discretionary time.

Outside NASA, Millis leverages the allure of science fiction to help teach and further explore options for interstellar travel. In 2005 he authored: "*Making the jump to light-speed*" a chapter in the National Geographic book: *Star Wars - Where Science Meets Imagination*. In 2006 he founded the international nonprofit Tau Zero Foundation. For hobbies, he builds scale models, Halloween costumes, and other mischief. Amidst all of this, Millis enjoys time as a husband and father.