

High-impact research + high-impact teaching

L. BRAD KING IS MICHIGAN Tech's top space researcher. The young ME-EM faculty member already holds more than \$1 million in grants from NASA and the Air Force for projects ranging from plasma thrusters to miniature satellites.

King is a recipient of the National Science Foundation Faculty Early Career Award as well as the Presidential Early Career Award for Scientists and Engineers.

As part of the Presidential Award, he received a five-year, \$500,000 grant to continue his research on high-powered ion propulsion engines which someday could be used for manned space missions to Mars.

Ion propulsion engines currently rely on xenon gas for fuel. However, xenon's price tag—about \$3,200 a pound—gives new meaning to the cliché “skyrocketing energy costs.”

In his state-of-the-art lab at Michigan Tech, King is experimenting with an alternative fuel that could slash the cost of ion propulsion. Bismuth, a brittle white metal, goes for about \$3.60 a pound and is much easier to handle and store. He has developed the critical system that enables bismuth to be used as a propellant—something that could greatly reduce the cost of space travel.



Q: What attracted you to aerospace engineering?

A: I have always been interested in space travel, astronauts, rockets, etc. When I was a kid I enjoyed building and launching model rockets. Of course, following the instructions included with the kit was never as fun as trying to re-engineer the rocket to go higher, which inevitably involved adding more and bigger engines. The launch failures were often spectacular and just as fun as the “successes.” Since then, I guess I have just moved on to bigger toys.

Q: Your patent on the bismuth plasma thruster is pending. How will your invention impact space travel?

A: In the near future, the concept described in the bismuth patent may enable the U.S. Department of Defense to consider new types of missions that would not be possible without high-power ion thrusters. One of the missions under consideration is a reusable “space tug.” The tug would be stationed in Earth orbit and used to tow other spacecraft to different locations in response to changing needs on the ground. In the long run, a very high-power bismuth ion thruster is a candidate for NASA’s Exploration Initiative and could be used for human or robotic missions to Mars.

Q: You involve all kinds of students in your research and space program—grad students, undergrads, and even high school students. How does that work?

HUSKYSAT

MICHIGAN TECH'S AEROSPACE Enterprise team excelled at the University Nanosat 3 competition last January, finishing third among 13 teams. Their satellite, "Husky-Sat" was one of only three entries judged to be flyable, or capable of successfully completing its mission.

L. Brad King, the advisor, credits his team's dogged tenacity. "About 15 of them gave up their Christmas holiday vacations to put on the final touches," he recalls. "For an undergrad, that's about the ultimate sacrifice."

Once in Reno, Nevada for the competition, they recreated their laboratory in a hotel room, working continuously for three days and nights. "We had an oscilloscope, power supplies, drills and power tools, wiring equipment and at least five computers," King said. "It was like one of those CIA movies, where everything seems normal in the hallways, and then you go into the room and have this high-tech laboratory where everything is beeping and clicking."

That determination paid off, and the Michigan Tech team had HuskySat ready to show the judges. The first and second place schools, the University of Texas at Austin and Washington University, also arrived with completed satellites. In addition, they had finished about a month ahead and had undertaken a number of tests on their entries, which earned them additional points.

"They were deemed further along," King said. "That's what killed most of the other schools. Two years to build a satellite isn't a lot of time."

A: There is an often-repeated quote that says, "If you really want to learn something, try teaching it." The greatest benefit I see from including students at all levels is the amount that the students learn through teaching younger students. Although I personally interact with all of the groups, primarily I strive to have graduate students supervising undergraduates, senior undergraduates supervising underclassmen, and undergraduates supervising high-school students. This encourages (and requires) each student to fully understand both the fine technical details of their particular assignment along with the "Big Picture" stuff that they might ignore if they didn't have someone less technically mature making challenging inquisitions.

Q: Are you entrepreneurial by nature?

A: I guess that I am. Outside of my university position I also own a research and development company. This corporate entity serves as a great portal for taking the fundamental knowledge gained in a university environment and turning it into an application or product. I find this is a great way to inspire and stimulate fundamental research because I can take an idea to a greater level of maturity than basic research alone—the end product is an application, rather than a publication.

Dr. L. Brad King is an experimentalist with expertise in non-neutral plasmas, charged particle traps and electric space propulsion systems. He earned his PhD in Aerospace Engineering from the University of Michigan in 1998. A Fellow of the NASA Institute for Advanced Concepts (NIAC), King is also a member of the NASA Nuclear Space Propulsion Technology Assessment Group.



From PowerLabs to Junkyard MegaWars—and beyond

SAM BARROS, A 21 YEAR OLD native of Sao Paulo, Brazil, created his own web site, www.PowerLabs.org to chronicle his efforts as an amateur scientist, inventor, and mechanical engineering student at Michigan Tech.

A few years ago, PowerLabs.org was reviewed in *USA Today* and *Electronics Weekly*, and word got out. MTV asked Barros to perform wacky experiments on a microwave oven for its "Big Urban Myth" show. Next, producers at TLC invited Barros to be on "Junkyard MegaWars." Then Discovery Channel featured Barros on two of its programs, "One Step Beyond" and "Daily Planet".



Meanwhile, *Fortune* magazine profiled Barros along with several other "high voltage hobbyists". And, most recently NBC's "Fear Factor" hired him to help design, construct and implement a 40 foot electrified maze stunt.

Barros will graduate this year. Along with all the publicity, his tireless research has earned him corporate sponsorship, prizes at numerous science fairs, and soon, he hopes—the right job offer.

