

# The road to space goes through Manhattan, thanks to NASA grant

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There is a saying that technology makes the world smaller each day. Thanks to a team of researchers at K-State, it may not be long until Earth's solar system starts to shrink as well.

Funded by a \$1.2 million grant from NASA, a group of K-State researchers and engineers will spend the next three years studying the physiological changes to the human body caused by low-gravity environments.

"NASA is very interested in knowing what kind of physical fitness an astronaut needs when they arrive at a particular destination," said Thomas Barstow, professor of kinesiology. "One of the things that happens in space flight is our whole body deteriorates; our cardiovascular system is affected, our balance is affected, and what NASA wants to know is, given this deterioration, how strong do astronauts need to be to have the strength necessary when they arrive at the moon or on Mars?"

During an expedition to a planet, astronauts could have to perform any number of physical feats, from gathering rock samples to climbing up and down the ladder of the lunar module. To understand the amount of strength required to perform these activities, especially after muscular deterioration occurs during space travel, Barstow and Carl Ade, graduate student in anatomy and physiology, will study data collected from a series of physical tests performed by dozens of research volunteers over a three-year period.

"We are going to compare performance on a lunar obstacle course with exercises that we do in a lab," Barstow said. "These are standard tests like push-ups and sit-ups. They will also do a 'max-run'



Courtesy Photo

K-State will collaborate with NASA to study how the human body copes with low gravity and muscular deterioration

on a treadmill along with some 'max-arms' tests. That is year one."

In the following two years, Barstow and Ade will ask participants to complete a lunar obstacle course while attached to a support system designed to simulate a low-gravity environment.

"We hope to characterize the strength and endurance that each subject has, and then compare that to what they can do on the lunar obstacle course," Barstow said. "Because of the different gravity, the physical costs of the movement will be different. The obstacle course will allow us to make physiological estimates as to how much it will cost to move on the moon or on Mars.

"At the end of the day, as people at NASA like to say, what they want to know is if an astronaut is fit enough to go outside of the space module and perform physical tasks," he said. "We hope to provide them with basic information about the strength and endurance necessary to perform those tasks."

To create a low-gravity environment, Steven Warren, associate professor of electrical and computer engineering, and Russell Taylor, engineer for the Electronics Design Laboratory, will construct a support system designed to suspend participants in a lunar-like levitation.

"Think of it as a system that is a lot like the cabling systems that Fox Sports uses to suspend a camera over a football field during the game," Warren said. "However, in this case, it is the role of the cabling system to follow the subject and continue to support their weight in a natural way."

The structure will allow researchers to modify the "gravity" in the obstacle course, creating a simulated moon environment in a normal gravity habitat. Of course, the design and construction of the support structure present some difficulties.

"A mobile reduced-gravity platform has never been developed to this level, so this project offers unlimited opportunities for creativity," Warren said. "The primary challenge will be to design a support system that does not create an unnatural feel for the subjects."

After construction of the support system is completed, the research team will need to find volunteers to participate in the study and then begin the long process of gathering data.

"That will be a major challenge. We need to find people to test, and we need to get them excited about being part of the research," Ade said. "Along with that, we need to take our information that we learn here at Kansas State and apply it to what might be happening on the moon or on Mars or on an asteroid."

To Ade, the applications and uses of the collected data are what will make this study so special.

"This is by no means the end of the road. A lot of what we learn here can go on to spacesuit design

or other hardware,” Ade said. “At some point all of this is going to need to be implemented into an actual spaceflight.

“I’m very excited that we get to do it. Just like it says in ‘Star Trek,’ ‘Space: the final frontier,’” he said. “It’s really cool that K-State gets to be part of that.”

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