

**Title:** A STEM Education Program Encompassing Asteroid Science, Technology and Exploration  
**Institution:** University of Arizona  
**City/State:** Tucson, Arizona  
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**Summary:** The University of Arizona (UA) is the lead institution for the Arizona Space Grant Consortium (AZSGC), a Phase I Designated NASA Space Grant College and Fellowship Consortium. The UA has recently been designated as an HSI and is one of our nation's leading space research institutions. Asteroid science, technology, and exploration is an important and exciting research and education theme at the UA that encompasses the College of Science and College of Engineering. For example, the UA's Catalina Sky Survey has been instrumental in discovering a large fraction of known Near Earth Asteroids. In addition, the UA leads the OSIRIS-Rex mission (PI: Dante Lauretta)—a first of its kind sample-return mission to the Near-Earth Asteroid, Bennu. These achievements make the UA an ideal institution to lead an effort in STEM education that creates excitement and instills a sense of adventure and discovery to a diverse community of minority students in the local community. This proposed program envisions project-centric, hands-on education that would place UA students and transfer students from the nearby Pima Community College in cutting-edge research labs at the UA and in direct collaboration with a NASA Center. UA and Pima students would be tasked in developing an exciting series of CubeSat missions, CubeSat centrifuge laboratories AOSAT 2 through 4. They will use the student-built AOSAT-1 as the template. On AOSAT-1 minority students made-up 50% of the team and was representative of local demographics. These on-orbit labs will be built and operated by students and they will simulate asteroid surface conditions and will be used to advance the science and technology pertaining to asteroids.

Asteroids are recognized to be a common hazard, and although the specific impact probability at any location on Earth is small, the consequences of a direct hit can be substantial. The 2013 airburst of a 17-m diameter meteoroid over Chelyabinsk, Russia was equivalent to a 500-kiloton explosion. A relatively minor event, it caused millions of dollars of damages and injured thousands. But asteroids are also a great scientific and economic opportunity. Scientifically, they are easy targets for space missions that seek to answer the origins of the Solar System or origin of life on Earth.

Economically, these very same bodies have resources that could be leveraged to enable the kinds of adventures in space that are dreamt of in science fiction, providing water, fuel, and radiation shielding for human exploration. Some of these bodies have platinum-group metals being estimated in the trillions of dollars. To appreciate this threat and to assess this scientific and economic opportunity, UA and Pima students will focus on developing science experiments, lander and surface rover prototype to explore the surface of asteroids and perform In-Situ Resource Utilization (ISRU). The students will use AOSAT 2 through 4 to test their hypothesis.

These factors make asteroid science, technology and exploration an exciting vehicle for hands-on education of minority students. In addition, this opportunity provides these students' valuable connections to peers, to graduate student who are emerging technical leaders, accomplished

researchers in this field, and by extension to industry. Our past efforts have shown that involving new students in front-line research projects helps bring out student creativity, new and diverse ideas, and instill drive, purpose, and ambition. Working with UA and Pima undergraduate students in turn helps graduate student mentors advance their leadership skills, get teaching experience, and sharpen their research efforts. Importantly, the proposed program educates students through hands-on, motivational skills and experience—an experience that will enable them to open doors to opportunities in the high-tech science and technology sectors and meet NASA education goals by strengthening the future workforce for NASA and the nation.