JOSEPH GRAVES IV, SIERRA PORTILLO, BRYAN SWAUGER, JOHN KUHLMAN, and AARON DUNKLE, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, 26506. **Development of magnetic solder for improved solder joints formed in microgravity.**

Manned space exploration depends heavily on reliable spacecraft hardware and electronics. On Earth, several common techniques for repairing these electronics exist, primarily via replacing a failed component via soldering. However, in space, microgravity reduces solder joint strength. A solder joint is the term for the connection between an electronic component and a circuit board.

This project is exploring use of magnetic solder pastes to remove flux vapor bubbles that form in solder joints. These bubbles and voids weaken the joint strength, and reduce electrical conductivity of the joint. This impacts functionality of circuits and electrical components onboard the spacecraft. With funding from NASA USIP award NNX16AL83A, soldering experiments will be performed aboard a Zero-Gravity aircraft. The team of eleven undergraduate students, one graduate assistant, and one faculty advisor will test several soldering methods (including hand-soldering, induction heating, and reflow ovens) in microgravity in the presence of a magnetic field, and compare the strength and voidage of the resulting solder joints. Void percentages in preliminary research ranged from 4% to 35%, with higher voidage seen for joints soldered in microgravity.

Results from these experiments will provide valuable insight on repairing electronics in microgravity conditions. If the team successfully develops a magnetic solder paste that reduces joint voidage, future space missions may no longer need to carry spare electronic boards aboard spacecraft. Enabling inflight electronics repair will be crucial for future space missions, by reducing both the launch mass and mission cost, as well as extending the life of long-term missions.