Nathaniel Lee

**Award:** Undergraduate Student Research; $4000.00

**Status:** Junior, Physics

**Advisor:** Kevin Crosby

**Research Topic:** Development of Fuel Gauging Methods in Microgravity

**Abstract:** Since 2011, the Modal Propellant Gauging (MPG) team, consisting of multidisciplinary undergraduate researchers from Carthage College, has been developing and testing a fuel gauging system for use in microgravity environments. Using experimental modal analysis (EMA) techniques, the goal of the MPG project is to develop a flight ready technology that gauges fuel in microgravity environments by correlating the modal response of a 1-g equilibrium surface to the microgravity surface response at the same fluid fill level. The technology has been tested aboard parabolic flights via a manned parabolic flight payload. The payload consists of two propellant tanks and is designed to measure the modal response of each propellant tank to an injected white noise signal via piezoelectric sensors. Flight data shows that the MPG method can measure fuel with greater than or equal to 1% resolution at and below 50% fill levels. Under funding from the Wisconsin Space Grant Consortium during the summer of 2017, the MPG team made improvements to the parabolic flight payload in addition to designing a new payload for use aboard a Blue Origin New Shepard research flight scheduled for the first half of 2018.

**Biography:** Nathaniel (Nate) Lee is a junior at Carthage College. He is majoring in Physics, and  
 minoring in Computer Science and Mathematics. Post graduation, he would like to enter the field of Aerospace Engineering and contribute to the growing fields of deep space exploration or unmanned aerial systems. He is entering his second year as a member of Carthage’s rocket team, Lake Michigan Launchers, and has also participated in the RockSat-X and microgravity research programs at Carthage. Apart from his roles in science-related programs, he holds two part-time jobs, is a member of the varsity golf team, and is president of the Asian-Pacific American Coalition of Carthage. In his free time, he enjoys playing golf, learning about and working with \cars, and exploring new areas of science that aren’t introduced in the classroom.

**Congressional District:** 1

**Congressional Representative:** Paul Ryan