MECHATRONICS ENGINEERING

Pushing the Limits

By Joëlle Walls

Jay Strickland is on a mission – to push the limits of research and technology – while he is a student at Kennesaw State. To fulfill his dream of becoming a developmental engineer with the U.S. Air Force, he is studying mechatronics engineering in the Southern Polytechnic College of Engineering and Engineering Technology.

When he got out of the military in 2016, Strickland looked at different career options. He was most interested in the field of control systems, having gained communications electronic repair experience from his time serving in the U.S. Marine Corps.

"Control systems were really interesting to me. The idea we can turn sand into silicon computer chips that we then program to do a variety of tasks related to industry applications in automation and robotics is amazing," said Strickland, a junior from Marietta who transferred to KSU in 2018 from Georgia State.

Jay Strickland will present his project at the 2019 National Conference on Undergraduate Research hosted by KSU.

"Mechatronics is the most direct application of controls systems engineering. I really think as far as undergraduate degree programs, especially in Georgia and the Southeast, there is no other program than the one at KSU that has such a sharp focus on direct applications of controls theory," he added.

Throughout his college career, Strickland has been accustomed to completing design projects as part of his coursework. However, an introductory class to the KSU mechatronics engineering program last spring gave him the opportunity to explore and push the limits of his imagination. Taught by Associate Professor Kevin McFall, one of the assignments involved writing about the experience of participating in one of the dozen KSU student engineering clubs offered on the Marietta Campus.

Therefore, Strickland joined the KSU Aerospace Competition Team, whose members were getting ready for a design-build contest in the Southwest. The objective was to launch a rocket 10,000 feet and deploy a payload that would fall safely to the ground, allowing for successful recovery of all the pieces. With his interests in controls and sensors, he focused on the payload recovery aspect of the project. Although there was not enough funding for the team to build the full rocket, Strickland continued with the research independently on the payload recovery system.

"Jay approached me through our class interaction with his ideas for patents, and I have mentored him since then on how to work together with KSU to develop his ideas," said McFall, also interim department chair. "Jay is a unique student with clear ambitions and specific business plans he wants to pursue alongside his studies."

After looking at various payload recovery systems that include parachutes or even drones, nature provided Strickland with his innovative design. He developed a payload recovery device, which simulates the autorotation ability of the samara, a tree seed also known as a whirlybird that spins while it falls to the ground.

"Due to the wing shape of the samaras when they fall to the ground, the autorotation helps them slow their terminal velocity. By the time they hit the ground, the samaras would be falling at slower rates that prevent damage upon impact. From my research, I found that the samara has been studied more than autorotation itself," explained Strickland. As part of his project, Strickland photographed samaras falling at high speed to understand the autorotation phenomenon. He then used shuttlecocks, or birdies used in badminton, for further analysis of autorotation when the birdies were cut open and expanded to full width. Since the original design-build competition encouraged the use of the CubeSat standard, a type of miniaturized satellite measuring 10 cm x 10 cm x 10 cm or 1 U, Strickland employed this spacecraft platform as part of his build.

"CubeSats are growing more and more popular as the standard platform for deploying research-based payloads into space," said Strickland. "Since 2010, NASA has completed launches of university and educational projects using the CubeSat. It is exciting that we can use these small and economical satellites for conducting experiments and testing new technology in space."

Strickland said that he hopes his initial prototype can become a more finished product that can be tested at 10,000 feet with the eventual possibility of commercially licensing the design to a company such as a CubeSat manufacturer. Industry applications may include using the payload recovery system for expediting high-demand shipments to consumers or delivering rations and medical supplies to soldiers in remote locations. The Kennesaw State University Research and Service Foundation (KSURSF) has filed a provisional patent application for him to protect the intellectual property.

"It is great the Office of Research and others help support such students who want to expand their university experience beyond the classroom," said McFall.