Project ARROW: Autonomous Rocket Return on Wings

Kolland, Benjamin

To decrease the distance of model rocket drift after deploying a recovery system, the project goal was to develop a low-cost, guided system to bring a model rocket back to the launch area. After considering several recovery options based on previous large-scale NASA work, a rocket was constructed to test a guided parafoil system. Eighteen drop tests of the guidance module from buildings (6.5m to 16m height) showed that very small control inputs were adequate to steer the parafoil. Although tangling of lines was an issue in 5 of 18 drop tests, only a <5cm rotational arm was needed to provide control of the parafoil. An internal avionics bay was designed and after ground testing, a serendipitous design improvement showed this bay could double as both a guidance module and a piston to deploy the rocket recovery system. However, half of the launch vehicle tests still failed due to parafoil line tangling after deployment. Simultaneous to launch vehicle tests, navigational algorithms were simulated in MATLAB and ported to the Arduino guidance computer for autonomous recovery control. The Arduino GPS module was launch tested and collected data successfully. To overcome deployment difficulties, the final design used a larger 140mm diameter rocket, larger 2.5 square meter kite, and Arduino guidance computer for autonomous return to the target zone. Six test flights proved Arduino guidance and steering control were viable on the new design. This low-cost autonomous recovery system could have useful applications beyond model rocketry for small-scale payload delivery applications.

Awards Won:

Third Award of $1,000