

Project #16: **David Hu** and **Wenchang Tan**: *Novel mechanism for drag reduction using a hairy surface*

The research objective of this proposal is to test the hypothesis that hairy systems can control flow and reduce drag. Experimental measurements have already shown that the hair and feather systems of some avian and aquatic animals are able to control flow and reduce drag, but much still remains to be learned about the hydrodynamic mechanisms underlying these functions. The results from our pilot two-dimensional experiment show that the trapping of “dead” fluid and the modification of the wake pattern by the hairs may play important roles in the flow control process. In this project, we will conduct both two-dimensional and three-dimensional experiments with hairy bodies coated by soft rubber hairs for mimicking real animal hair systems. The drag force will be measured using different combinations of their physical parameters. Flow visualization and numerical simulation will be performed to investigate the interaction between hairs and fluid. Finally, a theoretical model will be built to calculate the drag exerted on hairy surfaces as a function of the hair rigidity, density, coating area and length. Advances in this area may help to save energy by improving the performance of aero and aquatic machines.