

AEROSPACE ENGINEERING AND ENGINEERING MECHANICS
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: 03/01/2020

PROJECT TITLE: Active Flow Control for Aircraft Maneuvering and Control

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Project Description

Active flow control is a field of study focusing on using actuators and sensors to impart energy to a fluid flow in order to control or modify the fluid behavior. An example of this is injecting a fluid into a low momentum boundary layer (friction layer between a fluid and a surface) in order to delay separation of the boundary layer. This can have many desirable effects such as reducing aerodynamic drag or providing a desirable change in the flow properties on a surface. Current modern aircraft are geometrically optimized for efficiency by using high-fidelity computational tools and building on 50 years of design modifications to the basic "tube and wing" aircraft design. In order to achieve further performance improvements and capabilities beyond what passive geometry can provide, active flow control can be harnessed. The applications of active flow control can be used to improve wing performance at high-angles of attack, improve engine efficiency, control undesirable fluid behaviors, improve aircraft maneuverability, and to reduce control surface sizes or eliminate them entirely.

This project will involve designing, building, and testing actuators for active flow control. The focus will be on a piezoelectric actuator that is driven by an electronic controller to achieve air flow pulsations. Actuators of different designs and sizes will be tested to characterize the output flow velocity and frequencies. The goal of the project will be to develop an understanding of the actuator capability and limitations in regards to the size and power output. The project will entail design (CAD), fabrication, and assembly of the actuators along with development of a data acquisition system (hardware and software) for controlling the actuators and recording data. This project will eventually result in testing of the actuators in a wind tunnel with an aerodynamic model.