# **FLAPPING WING MICRO AIR VEHICLE PROJECT (FWMAV)**

#### **BACKGROUND:**

As far as advancements have come in small-scale aerial vehicles, man-made creations are still outperformed by the stability, agility, and maneuverability of flying birds and insects. In recent years, advancements in understanding of these natural flyers have allowed for a new class of bio-inspired flying machines.

### **GOAL**

The goal of the FWMAV Project is to explore the advantages of flapping wing flight over conventional fixed and rotary wing applications. Through a systematic research approach, the combined efforts of the sub-teams should focus on *discovering* advantages, *creating* advantages, and *demonstrating* advantages of flapping wing mechanisms.



The System Identification and Visualization Team addresses the challenge of capturing the dynamics of flapping wings, and the fluid velocity field around these wings. The flow visualization rig is designed to serve as the basis for future PIV (Particle Image Velocimetry) research. The flow visualization rig is scheduled to be fully constructed by the end of Winter Quarter.

BUDGET		
QUARTER	F18	W19
MAE189 STUDENTS	\$2,080.00	\$1,920.00
MAE193 STUDENTS	\$200.00	\$100.00
MAE93 STUDENTS	\$28.00	\$28.00
TOTAL FUNDS	\$2,308.00	\$2,048.00



#### DESIGN MECHANICAL DESIGN

![](_page_0_Picture_11.jpeg)

![](_page_0_Picture_12.jpeg)

The Mechanical Design Team aims to improve efficiency and generation of thrust by designing and manufacturing an optimized flapping-wing mechanism. This mechanism is designed to recreate the active pitching of the wings in flying birds and insects. In addition, this team will perform experimental optimization of wing shape and material.

# **FUTURE WORK**

![](_page_0_Picture_15.jpeg)

System Identification & Visualization Team: Outfit flow visualization rig with PIV equipment, gather data on various flapping mechanisms, record flow visualization on different wing shapes Mechanical Design Team: Load-cell testing for coefficient of lift for various wing shapes, materials, and gear mechanisms

Quadflapper Team: Comparison testing between "Tinyflapper" and an analog small-scale quadcopter, large-scale Quadflapper converted to brushless DC motors, modification of FC firmware for optimized feedback loops

![](_page_0_Picture_18.jpeg)

Advisor: Professor Haithem E. Taha **Graduate Manager:** Fernando Pablo Quevedo Graduate Project Manager Assistant: Moatasem Fouda **Project Manager:** Nathan Cabezut

Mechanism Team: Wai Hnin Oo (Team Lead); Brandon Tong; Evan Gillett; Brian Nguyen; Pedram Kazemi; Natyeli Yepes; Hana Legesse

System Identification & Visualization: Tristin Nasser (Team Lead); Andrew Iwamoto; Jianzhe Hao; Orlando Baez; Benjamin Lam

Quadflapper Team: Samuel Hince (Team Lead); Branson Davis; Alejandro Aguilera; Mark Ostgaard, Andrew Kettle

## APPLICATION **QUADFLAPPER**

![](_page_0_Picture_25.jpeg)

![](_page_0_Picture_26.jpeg)

The Quadflapper Team aims to demonstrate the advantages of flapping wings in real-world applications. This includes comparison testing between a Quadflapper and a quadcopter, and development of a small-scale micro air vehicle version of the Quadflapper.