FLAPPING WING MICRO AIR VEHICLE PROJECT (FWMAV)

BACKGROUND:

FWMAV gets its name from the flapping-wing driving mechanism and Micro-Air Vehicle (MAV) class of aerial vehicle. The Defense and Research Projects Agency (DARPA) defines a MAV to be any unmanned aerial vehicle that is less than 15 cm in every principle direction. FWMAV project aims to study the dynamics of flapping wing mechanisms, optimize these mechanisms, and apply them to existing technology.

GOAL

Develop a micro air vehicle that derives thrust and stability from a flapping wing mechanism. The device needs to be less than 15 cm in every direction, that is capable for flying using advanced control system.

QUADFLAPPER

The Quadflapper subteam was formed to experimentally test the differences between a flapping wing propulsion system and a fixed wing rotary propulsion system.

By constructing two UAVs with identical batteries, motors, flight controllers and structures, the result is two systems with nearly identical weights, but different flight dynamics.





The Mechanical subteam focuses on the design and fabrication of a mechanism with an active pitching angle, powered by one motor.

We are currently working on optimizing a 2 stage gear system consisting of 2 wings and 1 motor. This optimization process includes running Solidworks simulations on our designs, researching high-quality, lightweight motors and gears, and improving wing material and shape.

In future quarters, the Quadflapper team will construct a downscaled version of the Quadflapper, referred to as the Flapping MAV (Micro Air Vehicle).





INNOVATION AND PROGRESS (FALL 2018)

<u>MECHANICAL</u>





FUTURE WORK

We plan to work towards creating a mechanism that can mimic the oscillation stabilization of large insects. We currently have the bird attached to a pendulum, but we are working to reach a point where the bird can hover on its own.



Advisor: Professor Haithem E. Taha

Graduate Manager: Miquel Balta; Fernando Pablo; Mohammadali Kiani.

Graduate Project Manager Assistant: Moatasem Fouda. **Project Manager:** Nathan Cabezut

Mechanism Team: Wai Hnin Oo (Lead); Brandon Tong; Evan Gillet; Brian Nguyen; Hien Le; Mohammad Alfeerawi; Pedram Kazemi; Natyeli Yepes; Hana Lagesse.

Simulation & Visualization: Lanjun Qi (Lead); Haocheng Yu; Yukun Sun; Andrew Iwamoto; Tristin Nasser; Jianzhe Hao.

Quadflapper Team: Samuel Hince (Lead); Branson Davis; Alejandro Aguilera; Mark Ostgaard.

SIMULATION & VISUALIZATION

This subteam was formed with the purpose of simulating physical aspects of the FWMAV alongside developing a model to better understand and optimize the flight.

We use slow motion video of smoke trials to visualize how wings interact with the surrounding air. This information is then used to accomplish the goals above.





This year we plan to implement Particle Image Velocimetry to gather quantitative visualization data. Currently our data is purely qualitative.

