An ornithopter is an aircraft that creates both lift and thrust through the motion of flapping wings. In this project, the aim is to design and create an ornithopter scaled similar to the tobacco horn worm moth with Professor Roger Quinn’s biorobotics research group. The initial prototype will be simplified to have just two wings. Many different designs for such vehicles exist, and most are biologically-inspired.

Thus, as a first attempt to create a working ornithopter, I will begin by reproducing a simple, rubber band powered ornithopter. Second, I will combine design elements from existing sources to create a battery-powered ornithopter with an on-board power supply and motor.

The primary inspiration for the final product will be DelFly, produced by a team at Delft University of Technology. The ultimate goal will be to then incorporate radio control into the design, resulting in a controllable air vehicle.

Design considerations / specifications
• Total mass ~ 15g
• Motor power necessary ~ 60mW/gram
• Wing flaps ~ 20Hz = 1200RPM
• Gear reduction ratio ~ 60/9
• 4 wings – X configuration
• – 20cm wingspan
• Fuselage – woven carbon fiber (CF)
• Wing LE; Wing/Tail ballasts – unidir. CF
• Mean dihedral – 12.5°
• Wing LEs should touch – “Clap and Fling”
• Wing planform needs to be flexible
• Icarex material (polyester base)
• CF-Reinforced at LE and with ballasts through wing – TE lags behind LE
• Tail planform should be rigid
• Icarex w/ CF around and through tail wing

Goals
• Review literature of ornithopter theory and existing designs
• Create low-budget preliminary prototype to test and demonstrate the feasibility of a flapping-wing micro air vehicle
• Design and construct an ornithopter with on-board motor, battery, and RC receiver
• Determine need for control surfaces and/or vertical stabilizer

Future Work
• Resolve the gear to wing connection
• Test the device with off-board power, then fully assemble
• Test the vehicle’s flight performance characteristics
• Add control surfaces and full radio control for remotely-controlled flight
• Evaluate potential improvements and improve design

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