

# Independent Research Project: Ornithopter

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## Objective:

To build and test a novel design for an ornithopter that can sustain **level flight** and land without sustaining any damage to the airframe (structure).

## Design and construction of Prototype:

The prototype will be built to test different theories regarding bird flight. It is also a test bed for the different types and number of wing surfaces. The prototype will utilize four wings (just the leading edge) with detachable wing surfaces. The fuselage will primarily be made of balsa wood and aluminum wires.

## Final Design and construction of Ornithopter:

The final design will make use of a compressed air engine to power the flapping wings and utilize the best wing and control surface characteristics of the prototype.

## Factors to consider:

- Cost, under a hundred dollars
- Air Resistance
- Friction between moving parts
- Wing surface configuration
- Number of wings (2 or 4)
- Empennage (tail section) configuration
- Flapping Frequency
- Stability

## Marking Scheme:

- Proposal (10% of total)
- Ornithopter (40% of total):
  - Aesthetics: 10%
  - Functionality: 10%
  - Originality: 10%
  - Workmanship: 10%
- Quiz (10% of total)
- Presentation (10 minutes, 20% of total):
  - Knowledge and Understanding 10%
  - Display of information 10%
- Write-up: *Efficiency of ornithopter* (20% of total):
  - Research 10%
  - Knowledge and Understanding 10%

## Resources:

### People:

- Professor De Laurier. E-mail: [jdd@utias.utoronto.ca](mailto:jdd@utias.utoronto.ca)

### Websites:

- Flap Design. <http://www.ornithopter.org/flapdesign1.shtml>
- BBC Science Shack.  
[http://www.open2.net/scienceshack/flying\\_make\\_pg1.htm](http://www.open2.net/scienceshack/flying_make_pg1.htm)
- Flapping Flight. <http://www.ornithopter.org/flapflight/birdsfly/birdsfly.html>
- Flapping Flight (different site).  
<http://www.nurseminerva.co.uk/adapt/flapping.htm>
- Bird Slow Flapping Diagram.  
<http://www.paulnoll.com/Oregon/Birds/flight-slow-flapping-diagram.html>
- Biomimetic Flight.  
<http://www.personal.psu.edu/faculty/l/n/lnl/097/anders/index.htm>