# Extending the Jumping Range of a Small Robot via Collapsible Gliding Wings

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## RESEARCH QUESTION

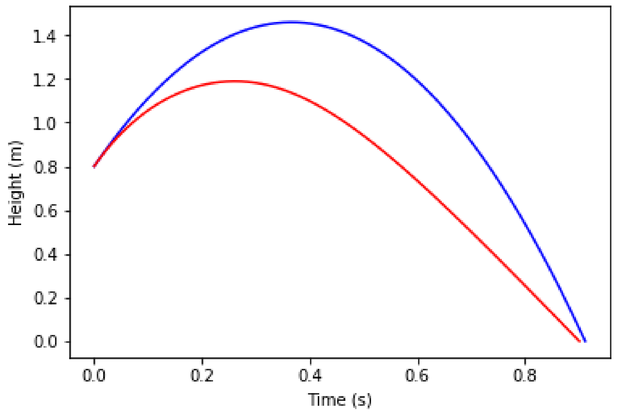
Can the benefits of a passively actuated gliding mechanism outweigh the drag and mass costs?

## MODEL

- Drag equation:

$$F_D = \frac{1}{2}\rho v^2 C_D A cos(\theta)$$

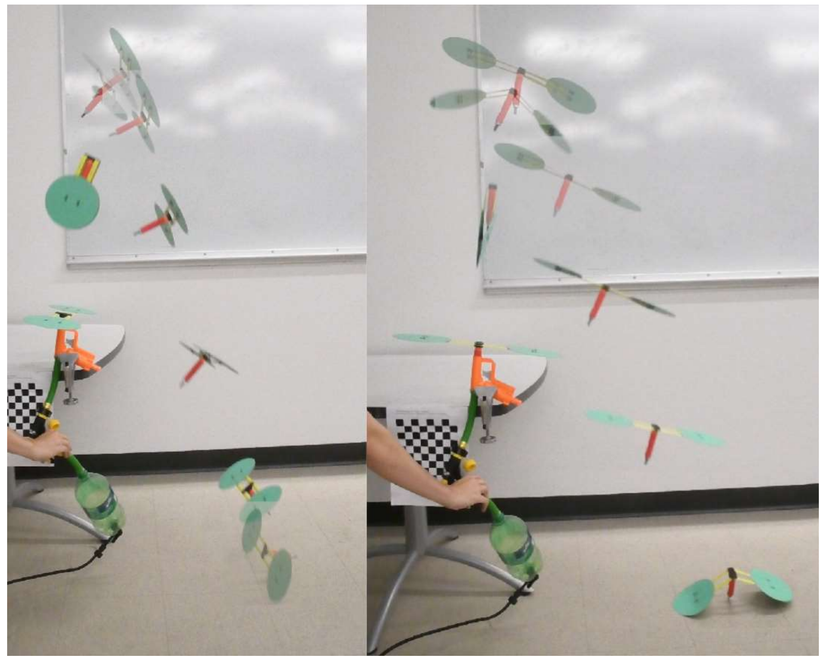
- $\rho$ = mass density of air = 1.29 kg/m^3
- $C_D$ = drag coefficient = 1.92 from drop test results




**Blue:** 0-drag mass
**Red:** glider with collapsing wings
Both have equivalent initial velocity and mass

## DATA COLLECTION

- Glider trajectories of drop tests and launch tests were recorded in 1080p 60fps video
- Videos were analyzed and the initial height, initial velocity, maximum height, and total time in the air were extracted. Also recorded were the approximate times for the collapse and extension of the linkages.



**Left:** axis between wings perpendicular to motion
**Right:** axis between wings parallel to motion

## RESULTS

- Current glider and linkage parameters incur too much drag to make up for decreased vertical with extended horizontal.
- The orientation of glider has a greater effect than expected and is worth further research.

| | Max Height (m) | Time to Ground (s) |
|---|---|---|
| **150 mm Diameter Wings, 20.8 g Payload 4.26 m/s Initial Velocity** | | |
| Experiment | 1.333 | 1.01 |
| Model | 1.331 | 0.94 |
| **200 mm Diameter Wings, 20.8 g Payload 4.26 m/s Initial Velocity** | | |
| Experiment | 1.192 | 1.02 |
| Model | 1.272 | 0.95 |
| **250 mm Diameter Wings, 38.1 g Payload 3.60 m/s Initial Velocity** | | |
| Experiment | 1.239 | 1.00 |
| Model | 1.189 | 0.90 |

FURI

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