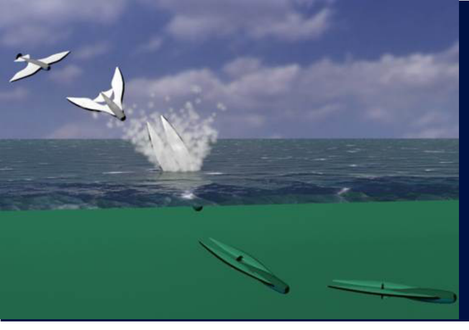

Hybrid Aerial Underwater Vehicle

Background

The MIT Lincoln Laboratory 2011-2012 SCOPE team was tasked with identifying an opportunity in the field of robotics for a novel and unique system, then building a proof-of-concept prototype for that system. The team was inspired by gannet birds, *Morus bassanus*, which are capable of a rapid, powerful and streamlined transition from air to water and identified Project Gannet as the robot to be built. The proof-of-concept system offers insight into the challenges of designing such a unique system and paves the way for building more advanced and more capable systems in the future.

Goal

The goal of Project Gannet is to build a remote controlled vehicle that is flight capable and is able to fold its wings, plunge-dive into water and navigate underwater.

MIT Lincoln Laboratory

Franklin W. Olin College of Engineering 1997

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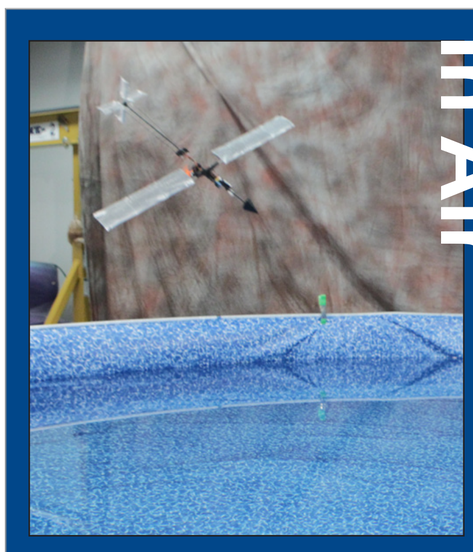
SCOPE
Senior Capstone Program in Engineering

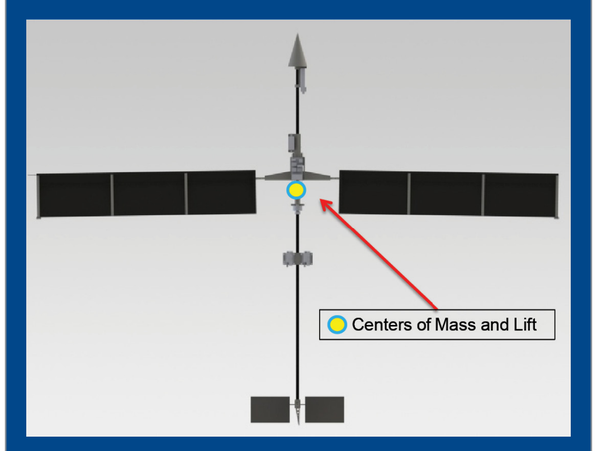
System Overview

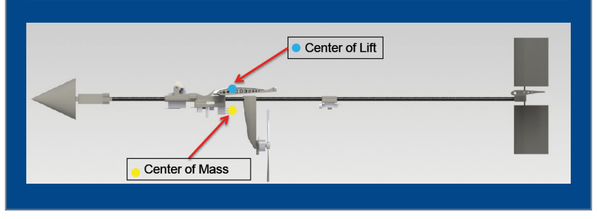
In Air



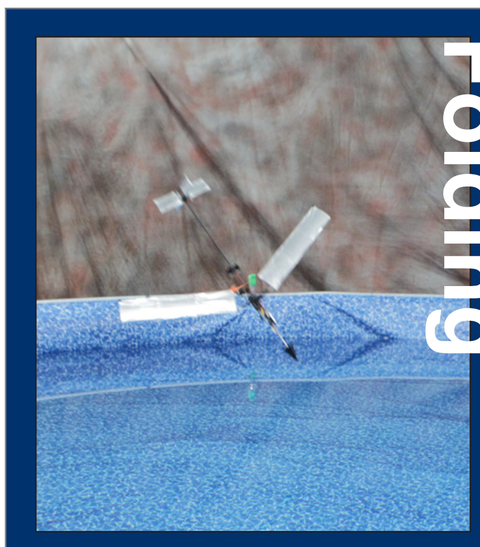
Weight balancing

- Must be balanced both in air and water
- Center of mass shifts when wings fold to improve balance under water
- Entire system designed to be as close to neutrally buoyant as possible



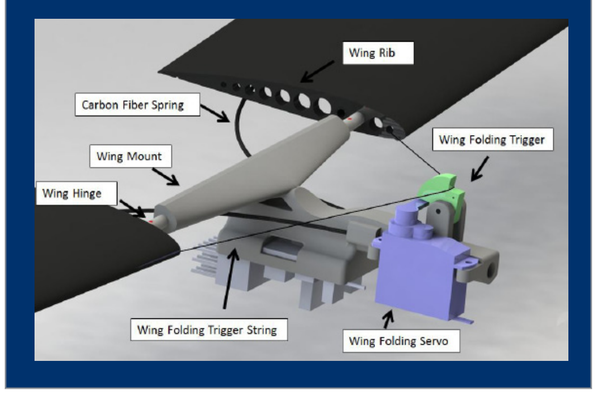


Folding



Wing folding mechanism

- Actively triggered wing folding mechanism
- Folding powered by elastic carbon fiber rods
- Wings folds completely in 0.25 seconds
- Folding mechanism accounts for 8% of the mass of the vehicle



Impact

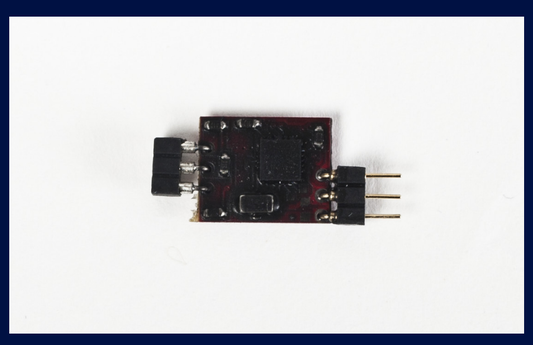
Impact

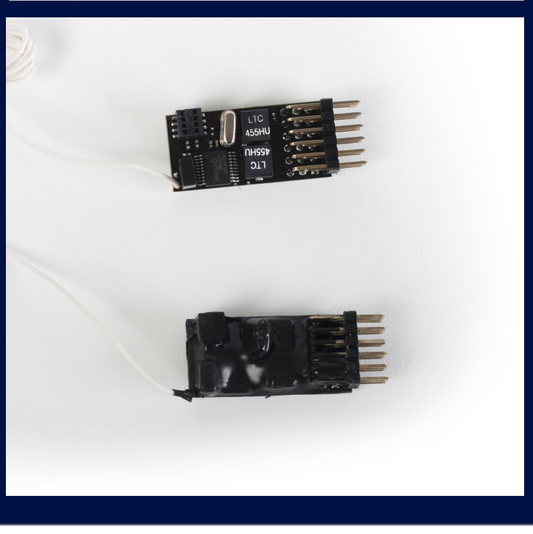
- At speeds above 7 m/s
- Front nosecone causes cavitation which protects electronics and wings
- Vehicle can smoothly continue motion into the water
- Prototype has survived multiple impacts

Underwater

Waterproofed electronics

- Multi-purpose rubber coating
- Can be sprayed or brushed over electronics
- Lightweight, rapid-dry and conforms to various shapes





Potential Future Directions

Autonomy

The current prototype is radio-controlled. By making it autonomous, it can accomplish various tasks without active participation of an operator. This requires a redesign for the electrical system to include additional sensors and processor.

Taking off from water

The vehicle currently can only transition from air to water. A redesign to allow it take off from water would give it much more versatility. Two problems need to be solved for this to happen. First, the wing folding mechanism needs to be redesigned to make the wings deployable after folding. Secondly the vehicle would require significant additional propulsion to breach.