

Design and Development of an Autonomous Return Vehicle

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Ram-Air Parafoil Targeted Object Return (RAPTOR) is an autonomous system designed for the simplification and cost reduction of High Altitude Balloon (HAB) payload recoveries. RAPTOR is designed to autonomously guide HAB payloads to a predetermined landing site using a mechanically articulated parafoil.

Background

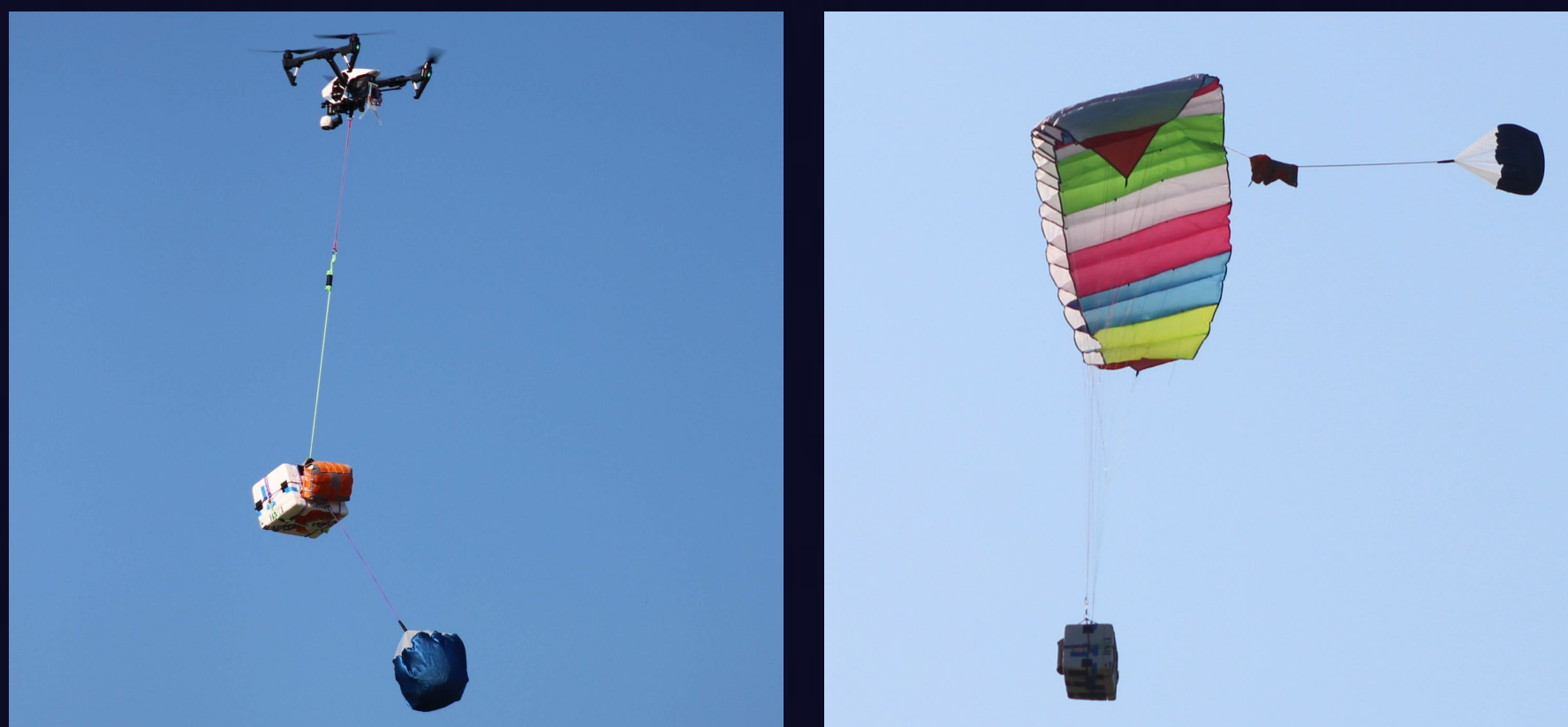


Figure 1 & 2: Drone drop of RAPTOR Phoenix

HAB projects typically involve carrying expensive payloads into the upper atmosphere to conduct scientific experiments. Currently HAB payloads are returned by unguided parachutes and frequently land in areas that make retrieval difficult or dangerous. The goal of RAPTOR is to serve as a reliable and reusable flight recovery system for future HAB projects.

Design Requirements

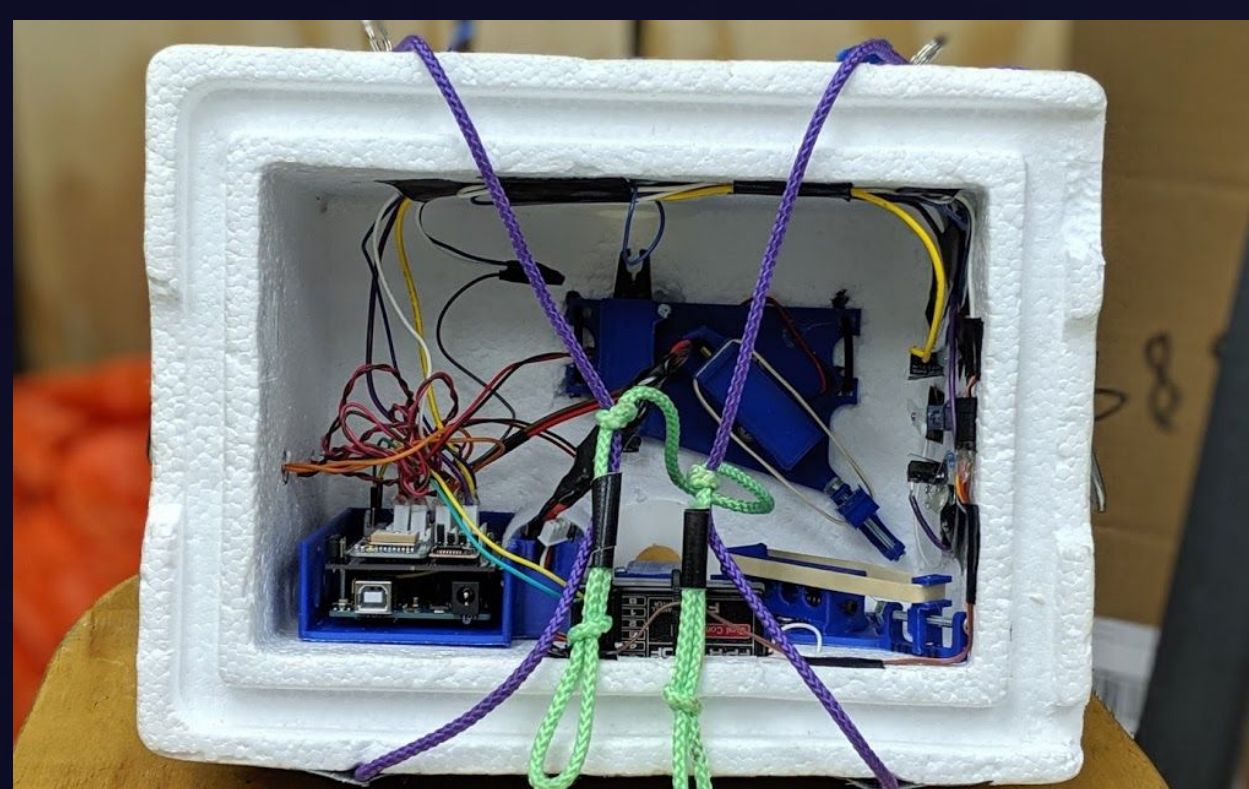


Figure 5: RAPTOR Phoenix electronics

RAPTOR aims to complete the following requirements:

- Remain under FAA limit of 1.8 kg, with parafoil able to maintain a safe descent rate of 7 m/s
- Release from balloon line at a specific altitude
- Achieve parafoil deployment during flight
- Autonomously guide payloads to a suitable landing location

Design



Figure 3: Lab testing RAPTOR Raptor



Figure 4: RAPTOR Phoenix

RAPTOR uses the following to complete the design requirements:

- Additively manufactured components
- Printed circuit boards
- Hobby paraglider parafoils
- Custom parafoil pack-bag designed for consistent deployment
- Solenoid based release mechanisms
- Servo controlled turning
- Basic flight algorithms and an inertial guidance system

To see more details, visit our *GitHub*:
<https://github.com/raptorshc>

Iterations

RAPTOR uses an iterative approach to project development. The previous, current, and future versions of RAPTOR are included below:

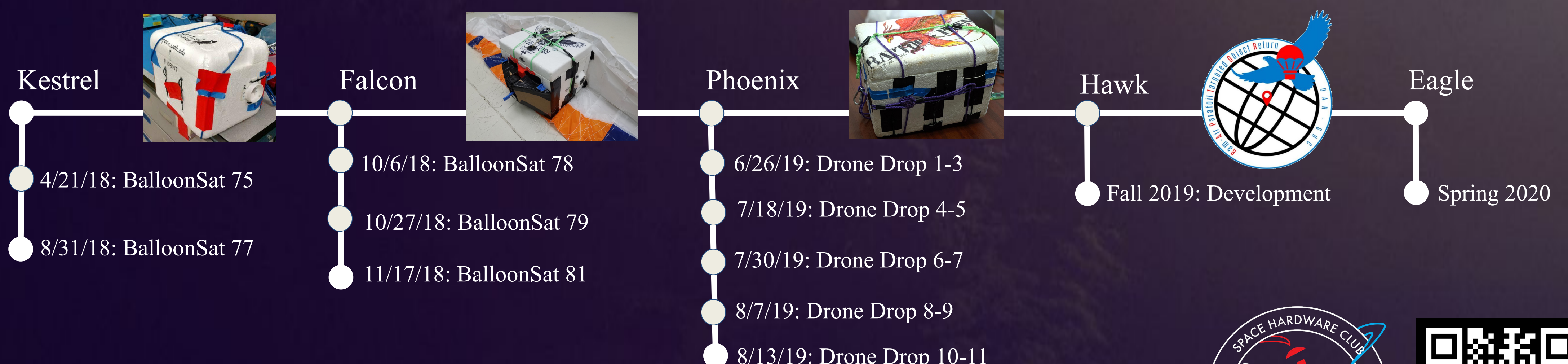
Kestrel: Proof of Concept

Falcon: First flights and initial bug testing

Phoenix: Test bed for cutdown mechanism and parafoil deployment

Hawk: Ability to carry a payload train

Eagle: Culmination of RAPTOR design improvements and final product



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