



RC DRONE DROP

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MECH 477, MECHANICAL ENGINEERING TECHNOLOGY, CAPSTONE SPRING 2025
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Introduction

Drones are changing the way healthcare is delivered. Especially in emergencies and hard-to-reach areas. Drones can quickly deliver medicine, blood, and vaccines where they are needed in rural areas around the world. In some areas drones deliver equipment, map infectious disease landscapes, conduct search and rescue missions in difficult terrain, and deliver medical supplies to remote areas, even before the ambulance arrives.

Background

Figure 1 and 2 illustrate two common drones used for medical delivery. Rwanda uses a zipline drone, which is small, lightweight, and shaped like a small airplane. The drone is placed on a catapult launcher that helps it take off quickly. When it reaches its destination, a parachute is deployed, ensuring a soft landing. Figure 2 is the skyports drone bases in United Kingdom. The drone has its cargo placed inside and it will follow a pre-programmed route using GPS. The drone will land, and its cargo will be removed.



Figure 1. Zipline drone by Rwanda.



Figure 2. Skyports drone.

Capstone Objectives

This capstone project aims to design a drone system to safely transport six eggs, representing delicate medical supplies, using a Q-Cop 450 drone (see Figure a). The mission involves taking off from point A, climbing to 100 feet, flying 330 feet horizontally to reach point B, and then delivering the eggs safely (see Figure 3). A custom holder will be used to secure the eggs during the flight, simulating how drones could transport medical supplies like vaccines, blood, and medications in the real world.

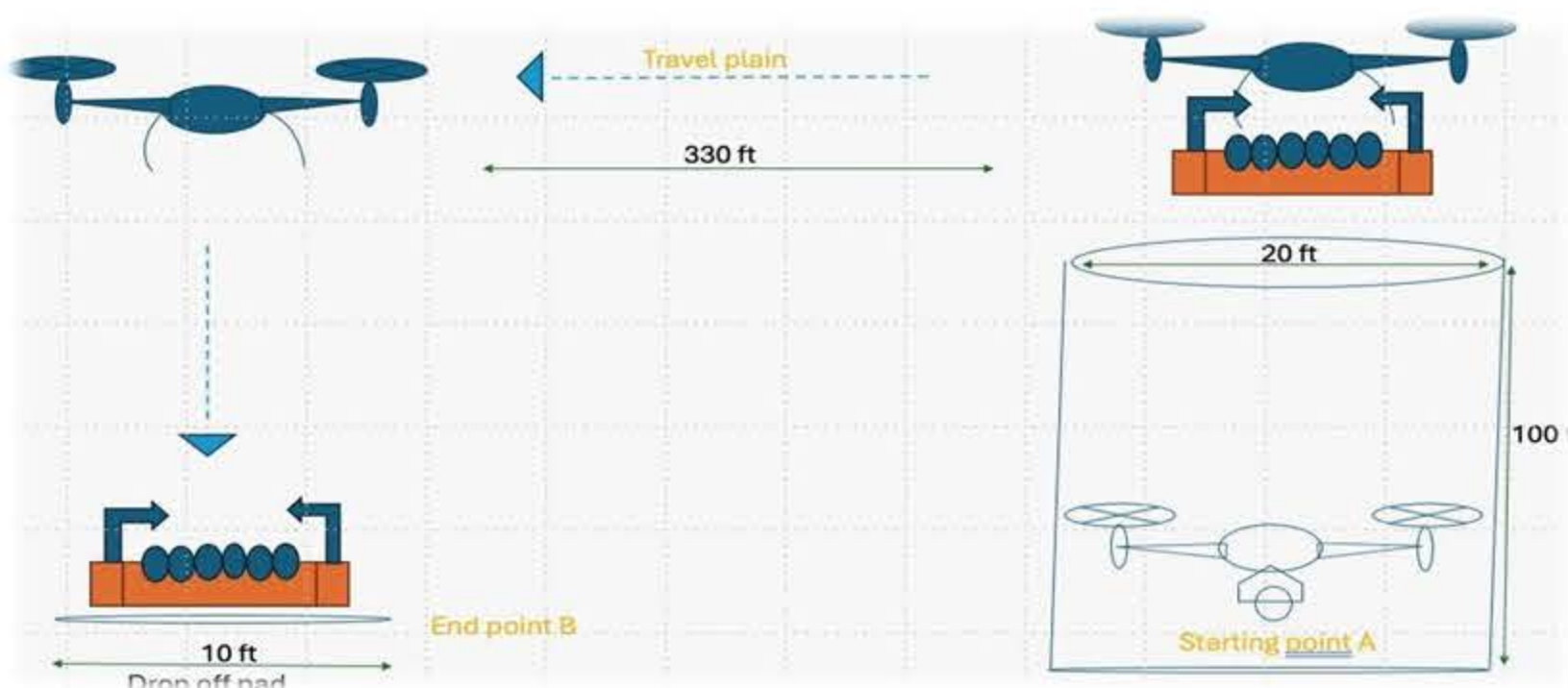


Figure 3. Schematic of drone flight path.

FAA Fly Rules

- Regulation of a minimum of 15 lbs can be transfers by a drone
- Drone + Cargo holder + load < 55 lbs
- Max altitude is ~328 ft
- Visual line of sight
- Required to have TRUST certificate and drone number on drone
- Required to be part of a CBO (Community-Based Organization)
- Required to have remote-ID

Customers' Requirements

- Transport 6 medium sized eggs (~300 g total of 6 eggs)
- Transport all the eggs from A to B in one trip in 5 mins
- Keeps eggs cold
- Prevents eggs from breaking
- Limited vibrations

Design Concepts

The holder case is designed to cover the original egg holder, securing the eggs in place during transport. This ensures the eggs remain safe and stable while the drone takes off and lands at its destination. The case features two holes on each side, allowing the servos to turn and lock the case securely in place. The bottom attachment connects from Figure 5 to Figure 4 to complete the locking mechanism.

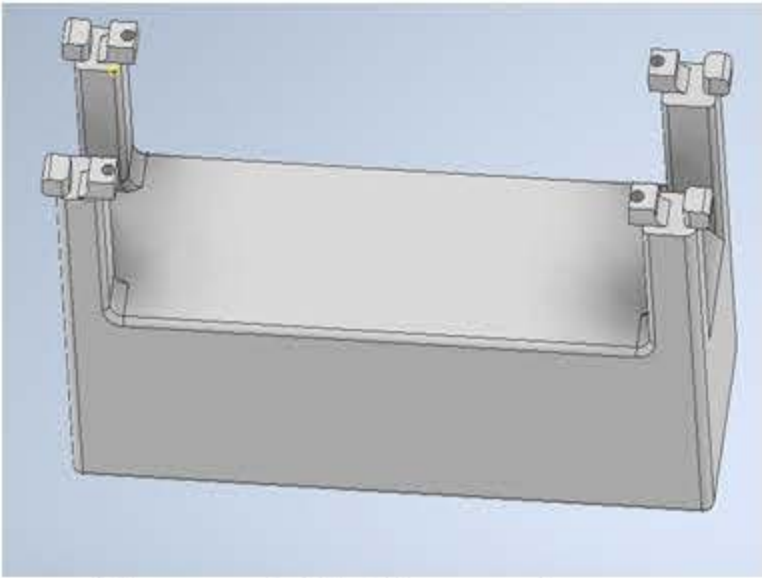


Figure 4. Holder casing.

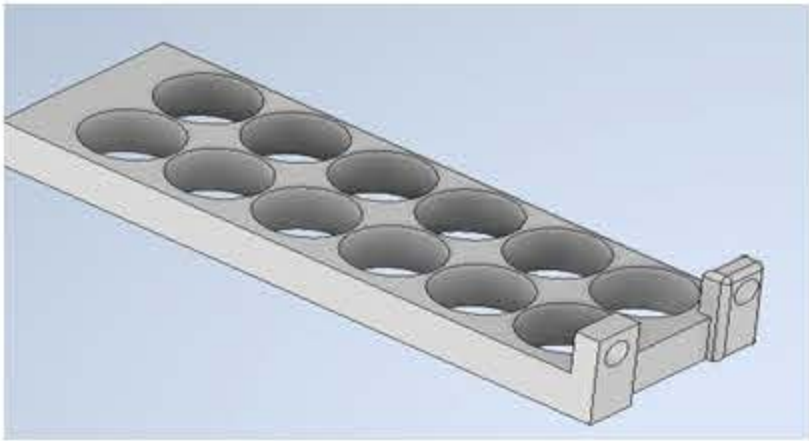


Figure 5. Bottom attachment holder.

Figure 6 illustrates a drop scenario where a string connects the drone to a parachute, which is attached to the egg. The string is cut by a spinning servo, releasing the egg and parachute. The egg then drops and lands on a pillow.

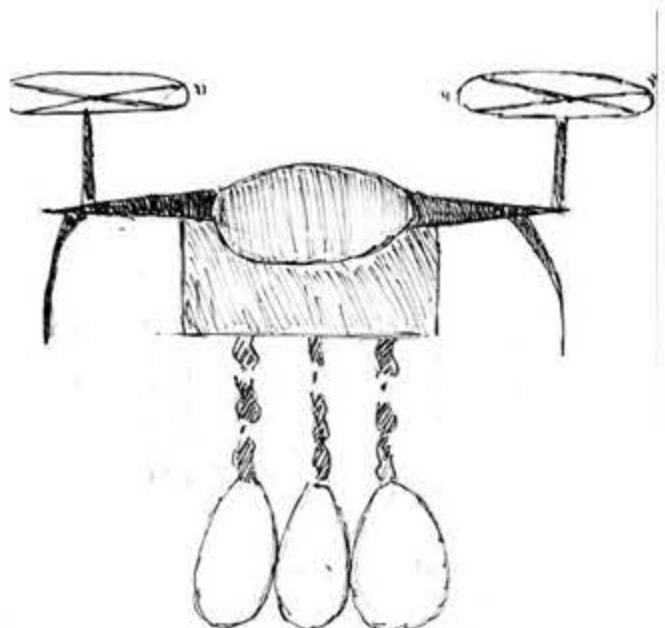


Figure 7. The Big Drop

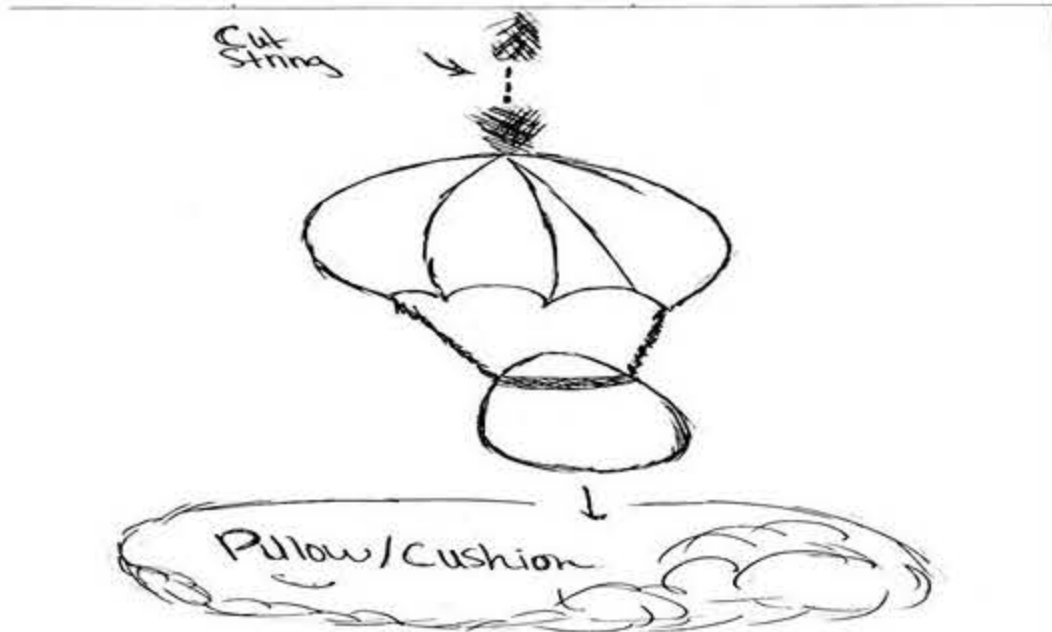


Figure 6. Parachute drop design.

In this mechanism, each egg is suspended by a string, and the timing of its release is controlled by cutting the string. When the string is cut manually the egg is released and falls freely known as the big drop

Weighted Objectives Table

Criteria	Weight	Case and holder Design	Parachute dropper	The big drop
Cost	4	3	3	4
Complexity	5	4	2	2
Durability	3	5	3	2
Ease of use	4	3	4	4
Weight	5	3	4	5
Total		74	67	73

Weighted objectives table evaluates three different models for an egg holder and drop-off mechanism.

- Each factor has been scaled according to its importance for the capstone project
- Weight and complexity received the highest ratings.
- The "Case with Holder" model and the "Big Drop" model are closely tied in performance.
- "Case with Holder" clearly stands out as the best option, with a slight advantage.
- Each factor has been scaled according to its importance for the capstone project.

Product Development

